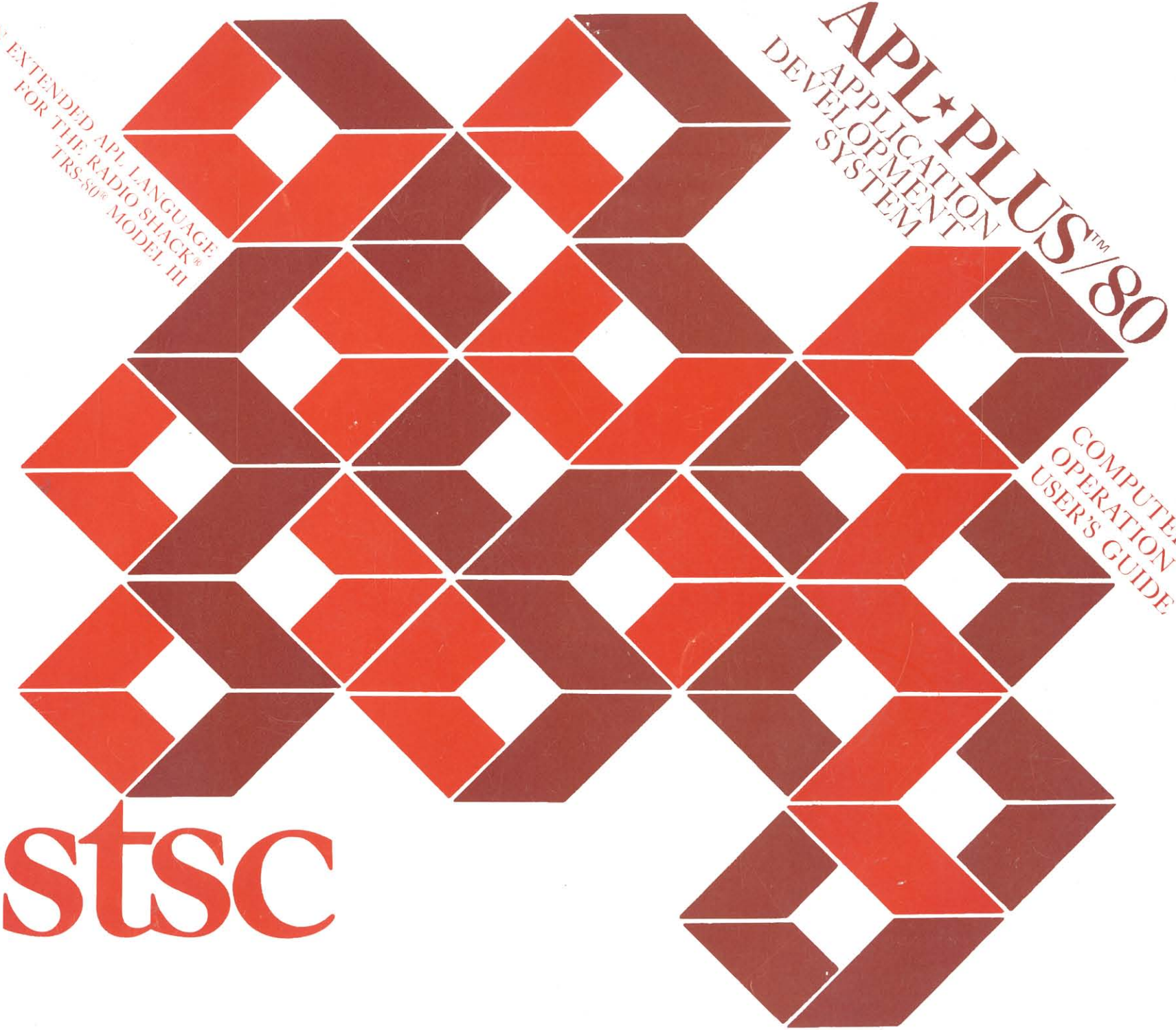
APL★PLUS™/80

APPLICATION DEVELOPMENT SYSTEM

AN EXTENDED APL LANGUAGE FOR THE RADIO SHACK® TRS-80® MODEL III

COMPUTER OPERATION USER'S GUIDE



stsc

APL★PLUS† /80 Computer Operation User's Guide

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INTRODUCTION

This manual describes how to use STSC's APL*PLUS/80 System on your Radio Shack® TRS-80® Model III computer. The manual is divided into seven chapters that provide the following information:

- Chapter 1 - Describes TRS-80 Model III components and controls, disks and disk drives, and explains how to start your computer and begin an APL session.
- Chapter 2 - Explains how to use your TRS-80 Model III keyboard during an APL session.
- Chapter 3 - Describes what you will see on your display screen during an APL session, and explains how you can change the display.
- Chapter 4 - Explains how you can edit information that you enter using the keyboard, and what your computer will do if you type information that APL*PLUS/80 can't work with.
- Chapter 5 - Describes how to properly end an APL session and explains why these procedures are so important.
- Chapter 6 - Reviews the steps in a typical APL session including beginning an APL session and ending an APL session, and explains how to run a stored program.
- Chapter 7 - Explains a few of your "housekeeping" responsibilities.

Following Chapter 7 are four appendixes that explain how to install the custom APL character generator; how to create an APL*PLUS/80 system disk under the TRSDOS™ operating system (supplied by Radio Shack); how to create an APL*PLUS/80 system disk under the LDOS® operating system (supplied by Logical Systems, Inc.); and keyboard and display control codes.

Material at the end of the manual includes a glossary of data processing terms, a list of references, and an index.

You don't need any previous knowledge of programming or even data processing to use this manual. All you need is a TRS-80 Model III with 48K RAM (Random-Access Memory), at least two disk drives, and TRSDOS Version 1.3. Your APL*PLUS/80 System will work on a TRS-80 Model III with only one disk drive, but you will only be able to save a small amount of data. This is because you must keep the APL*PLUS/80 system disk in disk drive 0 during an APL session since the system periodically reads system programs from the disk.

You can also use APL*PLUS/80 with LDOS Version 5.1. If you plan to use APL*PLUS/80 with the LDOS operating system, you will find a different set of software installation instructions and some notes about running APL under LDOS in Appendix C. Once APL is started, its operation under LDOS is practically identical to its operation under TRSDOS. Refer to Appendix C or your LDOS manual for specific instructions on starting the TRS-80 with LDOS.

> NOTE
>
> Please note that even experienced BASIC programmers should read this manual since TRS-80 operation while using the APL*PLUS/80 System is substantially different from TRS-80 operation while using BASIC.

CONVENTIONS USED IN THIS MANUAL

The following conventions are used in the text.

- Section titles, subsection titles, and keywords (words to help you find things you're looking for in the text) appear in the margins. Section titles are printed in uppercase letters, subsection titles are printed with initial capital letters, and keywords are printed in lowercase letters.

- Uppercase letters are used to indicate keys (such as CTRL and ENTER) found on your APL*PLUS/80 keyboard, and information that appears on your display screen.

- The APL character set is represented in uppercase italic letters. Items in italic letters (such as *)LOAD CHARSET*) represent information that you must enter exactly as shown.

- Words in the text that are underlined represent the first occurrence of glossary entries.

- "Press a key" means to press the key quickly (less than one second), just as you would press the keys on a push-button telephone when calling a number you know.

PREPARING THE KEYBOARD

In the front inside pocket of your APL*PLUS/80 binder is a sheet of self-adhesive labels. These labels include:

- An STSC APL*PLUS/80 System logo that you can apply to the front of your TRS-80.

- Disk drive numbers that you can apply to the front of your built-in and external disk drives.

- A placard with descriptions of APL*PLUS/80 fingertip controls that you should apply to the area between the video display screen and the keyboard of your TRS-80.

- APL keyboard labels that you should apply to the front of the keys on your TRS-80 keyboard.

You'll also notice that some blank, pre-cut keyboard labels are included. You can use these extra labels to replace pre-printed labels if the printed symbols should wear off with time and use.

Take a few minutes now to attach your keyboard labels. Turn off the power to your TRS-80 and then follow the directions printed on the label sheet. To make keyboard label application easier, depress the keys in front of the key you are working with.

INSTALLING THE CUSTOM APL CHARACTER GENERATOR

One custom APL character generator is supplied with your APL*PLUS/80 System. This "chip", when properly installed in your TRS-80 Model III, provides you with an accurate display of all APL characters.

Installing the custom APL character generator in your TRS-80 does not affect your ability to enter and run BASIC programs. It will, however, change some of the special characters that are not contained in the regular ASCII character set.

If you choose not to install the custom APL character generator you must use APL*PLUS/80 Keyword Form, where keywords are used in place of APL symbols. If you do install the custom APL character generator you can choose the form you prefer -- APL Symbol Form or Keyword Form. The APL*PLUS/80 Programmer's Reference Manual contains detailed descriptions of APL Symbol Form and Keyword Form. The examples in this manual are displayed as though you were using APL Symbol Form.

Before continuing with this introduction, please read Appendix A, "Character Generator Installation." Appendix A explains how character generator installation could affect your TRS-80 warranty, and gives you step-by-step directions for installing the character generator.

YOUR COMMENTS ARE WELCOME

We're eager to hear your comments on the APL*PLUS/80 Computer Operation User's Guide. For your convenience, a Feedback Form and postage-paid mailer are included at the end of this manual. If the form is missing, please send your comments to:

Publications Department
STSC, Inc.
2115 East Jefferson Street
Rockville, Maryland 20852

Be sure to include your name and address and the name of the manual.

CHAPTER 1

SYSTEM START-UP

Chapter 1 contains information on the TRS-80 Model III components and controls, disks and disk drives, and system start-up procedures. You'll not only learn the names of TRS-80 Model III components and controls, but you'll also learn how to properly care for disks and how to start the system and begin an APL session.

Before reading any further, take a few minutes to familiarize yourself with the various elements of your TRS-80 (see Figure 1.1). Even if you are an experienced TRS-80 user, Figure 1.1 will introduce you to some terminology we will use throughout this document.

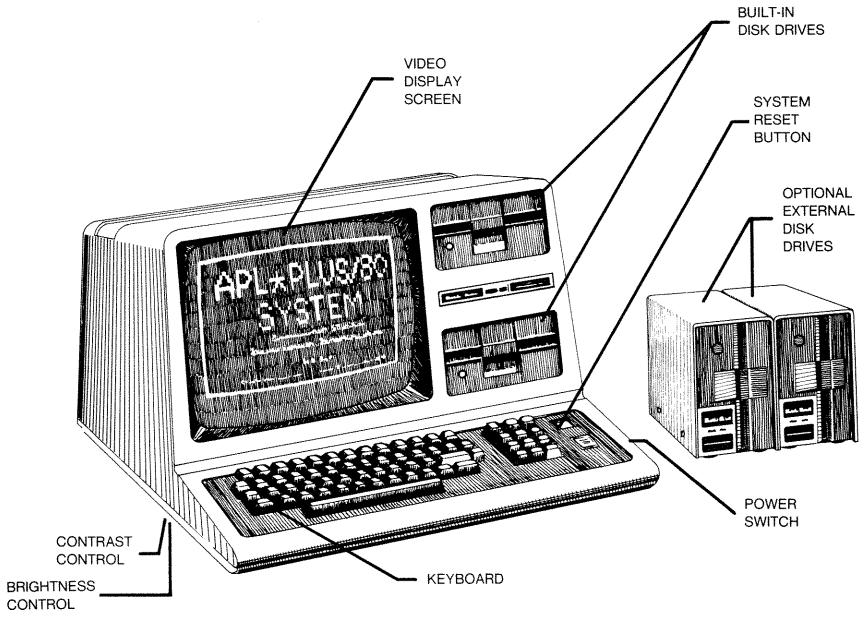

Figure 1.1 TRS-80 Model III Components and Controls

DISKS

> CAUTION
>
> Disks are fragile. Please read this entire section before handling your disks. Before reading any further, take a few minutes to familiarize yourself with the various elements of a disk (see Figure 1.2).

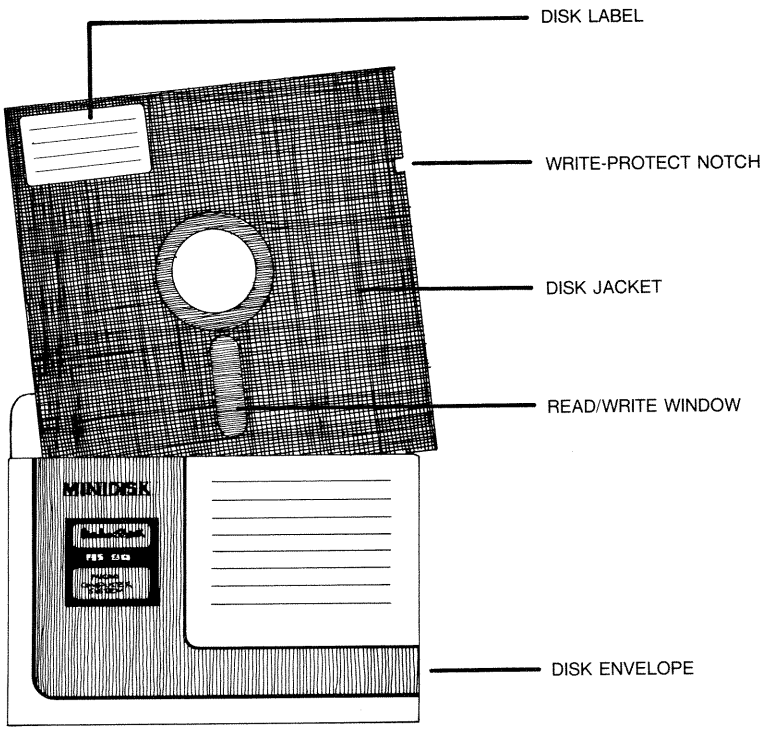

Figure 1.2 Disk Elements

Disk, diskette, floppy disk, flexible disk -- all of these words refer to a device that we use for permanent and semi-permanent storage of programs and data files. For simplicity, we'll just refer to this device as a disk.

disk

A disk consists of a round, mylar platter that's coated with magnetic material and permanently sealed inside a 5 1/4-inch square protective plastic cover that we call the disk jacket. When you insert the disk into a disk drive, the platter spins inside the disk jacket at a speed of five rotations per second and a special coating on the inside of the jacket cleans the platter surface. You should never try to clean the platter surface yourself or remove the platter from the disk jacket; doing so would permanently damage your disk.

For maximum protection, the disk should always be in one of only three places: stored in the disk envelope held in your hand, by the edge; or inserted in the disk drive.

disk envelope

The disk envelope is a paper container used to store a disk when it is not in use. To remove the disk from the disk envelope, squeeze the sides of the envelope slightly and pull the disk out. This way the disk envelope won't rub against the exposed surfaces of the disk.

read/write window

One of the exposed surfaces of the disk is an area called the read/write window. This oval opening in the disk jacket allows the read/write heads of the disk drive to access the platter. Never touch the exposed surfaces of the disk; this can permanently damage your disk.

write-protect notch

When you buy a new disk the write-protect notch is uncovered, allowing the computer to "write" on the disk, storing programs and data files. If you want to be able to change or add information, leave the write-protect notch uncovered. However, if you want to ensure that the information that is stored on the disk will not be changed, cover the write-protect notch with a special gummed foil tab (several are supplied when you buy a new disk) or any gummed label. When applying a tab to the write-protect notch, don't pinch the tab. If the tab becomes indented, the disk drive might not sense that the disk is write-protected.

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protecting your disks

Here are more tips for protecting your disks.

- When your disks aren't in use, store them in the disk envelope in an upright position -- just like you would store phonograph records. There should be little or no pressure against the surface of the disk.
- Never bend the disk.
- Use only felt-tip pen to write gently on the disk label. Lead pencil or ball-point pen might press through the disk jacket and damage the disk surface.
- Don't write on the disk envelope when the disk is in the envelope; this can damage the disk surface.
- Don't insert the disk into the front or back pocket of a three-ring binder. The disk could slip under the rings, which might damage the disk surface.
- Avoid contaminating your disks with dust, cigarette ashes, or other particles.
- Keep your disks away from heat and out of direct sunlight.
- Keep your disks away from electric or magnetic fields that could erase information that is stored on the disks; for example, the fields produced by televisions, radios, telephones, magnets, transformers, static electricity, and motors other than those in your TRS-80 Model III disk drives.

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DISK DRIVES

> **CAUTION**
>
> You may be unfamiliar with TRS-80 Model III disk drives. Please read this entire section before attempting to insert a disk into a disk drive. Before reading any further, take a few minutes to familiarize yourself with the various elements of a disk drive (see Figure 1.3).

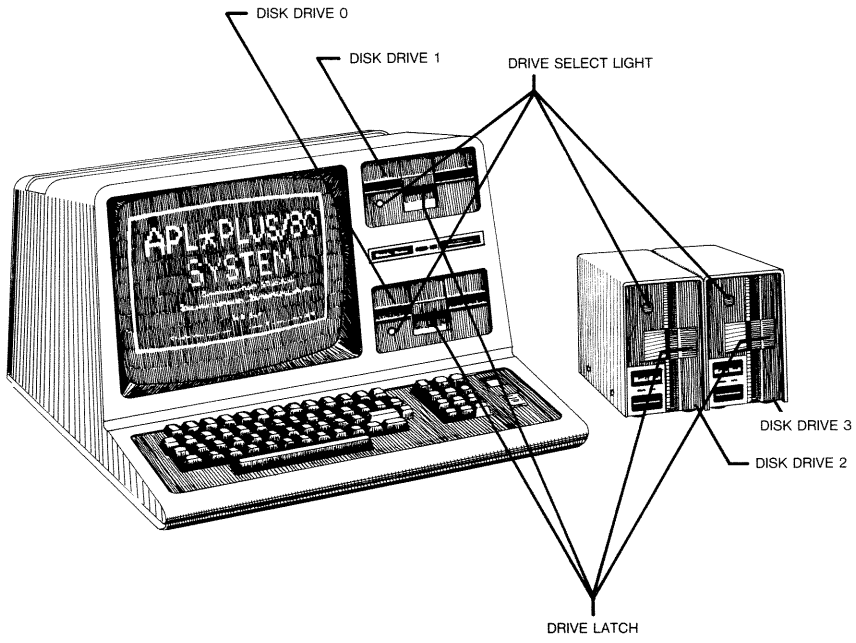

Figure 1.3 Disk Drive Elements

The typical TRS-80 Model III has two built-in disk drives and, without software modification, you can add two additional external disk drives.

disk drive numbers

Disk drives are usually referred to by disk drive number. On the TRS-80 Model III, the bottom disk drive is disk drive 0 and the top disk drive is disk drive 1. If you have added external disk drives to your TRS-80 Model III, they are referred to as disk drive 2 and disk drive 3. Disk drive numbers also indicate what type of disk is used in the disk drive. Disk drive 0 is used for the APL*PLUS/80 system disk. Disk drives 1, 2, and 3 can contain data disks.

drive latch

Access to the disk drive is controlled by the drive latch. When the drive latch is closed you can't insert a disk into (or remove a disk from) the disk drive. The drive latches on disk drives 0 and 1 are hinged at the top; to insert or remove a disk you must lift the drive latch out from the bottom toward the top. On external disk drives, however, the drive latch is hinged on the right; to insert or remove a disk you must lift the drive latch out from the left toward the right.

inserting a disk

When inserting a disk into a built-in disk drive, the write-protect notch should be on the left side, the read/write window should be on the edge farthest away from you, and the disk label should be facing up. Note that you should never force the drive latch to close. If the drive latch won't close easily, the disk is not inserted far enough into the disk drive; forcing the drive latch closed may damage the edge of the disk. Also note that the drive latch must be closed when a disk is in the disk drive; otherwise, the computer won't be able to read from the disk.

drive select light

Each disk drive has a drive select light. This small red light comes on when the computer is trying to use the disk drive -- even if there's no disk inserted and no data transfer is occurring. Note that you should never remove a disk while the drive select light is on; this can damage data that is stored on the disk.

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> IMPORTANT NOTE
>
> One final note for experienced APL programmers: you should never remove or insert a disk while the disk contains open files (files that have been "opened" by a program); otherwise, all or part of your file may be lost. If you have been working with files, be sure to close them by entering ⎕*FUNTIE* ⎕*FNUMS* or)*OFF* before you remove the disk.

START-UP STEPS

Before you can begin working with APL you must perform the five start-up steps. The five start-up steps, described below, are

- turn on peripheral devices, if any
- insert disks
- turn on your TRS-80
- adjust the screen display
- respond to the start-up dialog.

Turn on Peripheral Devices

Before turning on your peripheral devices be sure that the computer is plugged in.

Turn on all peripheral devices (such as external disk drives and printer).

Insert Disks

> IMPORTANT NOTE
>
> If your APL*PLUS/80 has never been used before, you must generate an APL*PLUS/80 system disk before proceeding with this section. Refer to Appendix B or Appendix C for specific information on generating your APL*PLUS/80 system disk.

Open the drive latch on disk drive 0. Remove your APL*PLUS/80 system disk from the disk envelope, carefully insert the system disk into disk drive 0 (see Figure 1.4), and close the drive latch. Insert other disks you want to use, if any, into disk drives 1, 2, and 3. (Note that these disks must have been formatted with the TRSDOS or LDOS operating system's FORMAT command, or copied with the BACKUP command from another disk. For more information on formatting new disks, see Chapter 7, "User Responsibilities".)

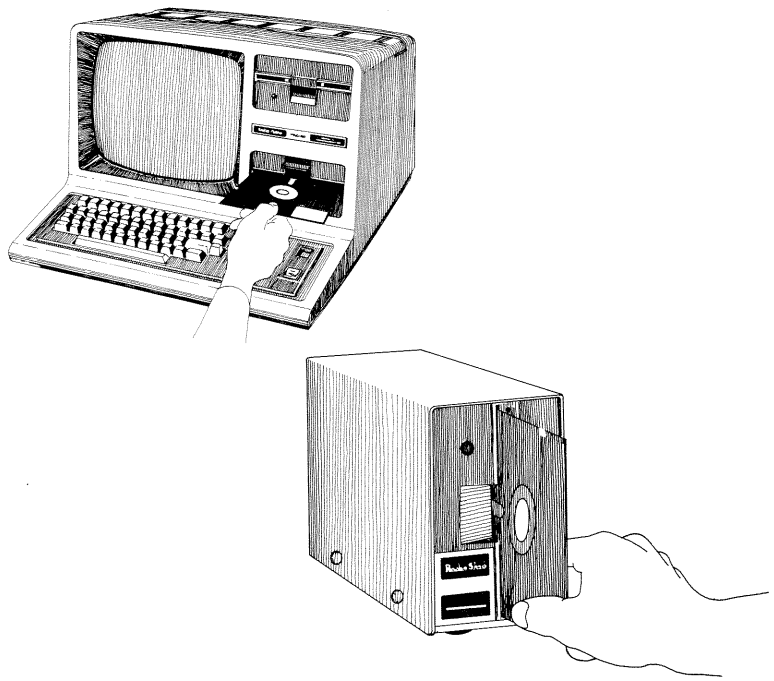

Figure 1.4 Inserting A Disk

Turn on your TRS-80

Turn on your TRS-80. The power switch on your computer is located under the right side of the keyboard (see Figure 1.5). Flip the power switch to turn on the computer; you'll hear a humming and buzzing sound. The humming sound is made by the disk drive motors starting. Wait until the disk drive motors stop and the drive select light goes off; the computer is loading and starting the operating system software from the APL*PLUS/80 system disk in disk drive 0 and setting the system clock to midnight.

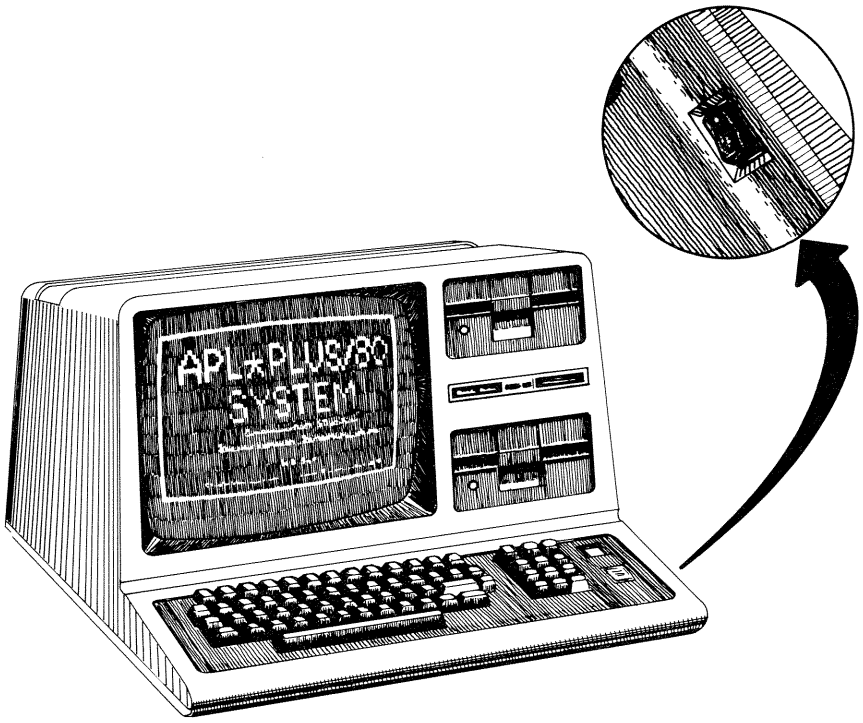

Figure 1.5 Power Switch

Adjust the Screen Display

At this point you can adjust the screen display brightness and contrast. The brightness and contrast controls are wheels located under the left-hand side of the keyboard (see Figure 1.6). You can adjust screen display brightness and contrast to comfortable levels as room lighting changes, as often as you like.

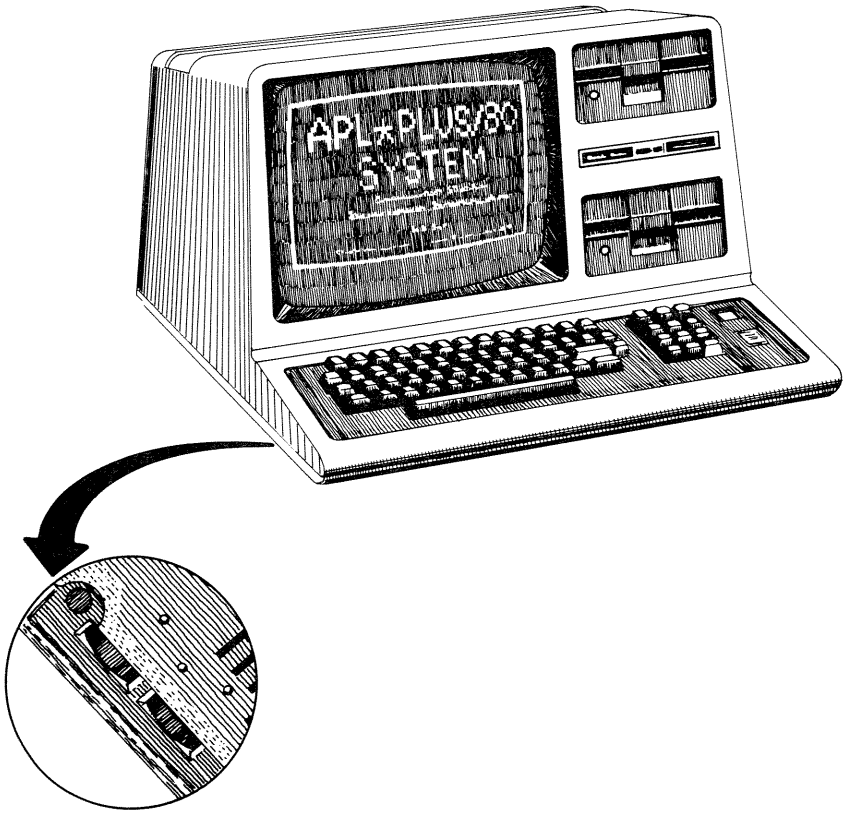

Figure 1.6 Brightness and Contrast Controls

Respond to the Start-up Dialog: TRSDOS

After you turn on your TRS-80 and the start-up program determines that everything is working properly, TRSDOS Version 1.3 not only displays a picture of your TRS-80, but also displays the TRSDOS version number and date of creation, and the amount of RAM and number of disk drives in your system.

enter the date

First, TRSDOS asks you to enter the date in the form MM/DD/YY; for example, 03/01/82 for March 1, 1982. Type the correct date. If you make a mistake while typing, you can correct the problem by pressing the backspace key (← on the key top) until the cursor erases the incorrect character and then typing the correct information. When the date is correct, press the ENTER key. Note that TRSDOS won't allow you to enter an unrealistic date (for example, 13/42/82), and TRSDOS won't continue until you enter a date that's in the proper format (MM/DD/YY).

enter the time

After you enter the date, TRSDOS asks you to enter the time in the form HH:MM:SS. You should enter TRSDOS time in twenty-four hour format; for example, 14:15:00 for 2:15 p.m. Type the correct time using the standard TRS-80 keyboard to type the colon; that is, press the key with a colon (:) on the key top, not the key with an APL colon on the adhesive label. You can use the correction procedures described above if necessary. When you have typed the time correctly, press the ENTER key. TRSDOS displays "TRSDOS Ready".

Start-up Dialog: APL

You are now ready to begin an APL session. Type *APL* and press the ENTER key. (If you plan to use your computer primarily for APL, you can type *AUTO APL* instead of *APL*, and press the ENTER key. In subsequent sessions, you can then skip this step.)

> IMPORTANT NOTE
>
> If more than one person will use your TRS-80, or if you want to protect your files and workspaces with a password, refer to the APL*PLUS/80 Programmer's Reference Manual and APL*PLUS/80 Shared File System User's Guide for information about distinct user account numbers.

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Fifteen to twenty seconds after you press the ENTER key, the APL*PLUS/80 System completes loading. While the system is loading the screen displays the STSC address, the APL*PLUS/80 version number and serial number, the system logo, and a license and copyright notice. After the system is loaded, the APL*PLUS/80 normally displays a "status line" at the bottom of the screen:

~~~~~~

However, this line might not be displayed if you are using an application that starts automatically for you. (For further details on the status line, see Chapter 3, "The Video Display".) At this point one of three things will happen:

- You will see a message welcoming you to APL.
- If another user has dropped the welcome message, you will see a message similar to:

  ```
  CLEAR WS 3/1/82 2.15.28 WA=20964 IO=1 PP=10 PW=64
  ```

- If you are using an application that starts automatically for you, you should refer to the documentation for that application to see what will be displayed and what you should enter on the keyboard.

Note that you are now using the APL*PLUS/80 System and, unless you are using Keyword Form, from this point on you must use the APL keyboard as described in Chapter 2, "The Keyboard". (See the APL*PLUS/80 Programmer's Reference Manual for more information on Keyword Form.)
~~~~~~

SUMMARY OF START-UP STEPS

Remember, before you can begin working with APL you should:

- Be sure that the computer is plugged in.
- Turn on all peripheral devices (such as external disk drives and printer).
- Open the drive latch on disk drive 0, carefully insert the APL*PLUS/80 system disk into the disk drive, and close the drive latch.
- Insert other formatted disks you want to use, if any, into disk drives 1, 2, and 3.
- Flip the power switch to turn on the computer, then wait until the disk drive motors stop.
- Adjust the screen display brightness and contrast.
- Using the standard TRS-80 keyboard (the symbols on the key tops), enter the current date and time.
- Type *APL* and press the ENTER key. (Note that this step is not necessary if you have executed the AUTO APL command in a previous session.)

```
Enter Date (MM/DD/YY)? 03/01/82
Enter Time (HH:MM:SS)? 14:15:00
TRSDOS Ready.............
APL
  .
  .
  .
```

CHAPTER 2

THE KEYBOARD

Chapter 2 contains information on the APL character set labels, shifted and unshifted characters, the numeric pad, special keys, character repeat, and keyboard and display control codes. After reading this chapter you'll understand how to use the APL keyboard while your computer is running the APL*PLUS/80 System.

Before reading any further, take a few minutes to familiarize yourself with the various elements of your keyboard (see Figure 2.1). Compare the keyboard in Figure 2.1 to your keyboard. Be sure that the adhesive APL character set labels that you have applied to the keys are in the correct positions.

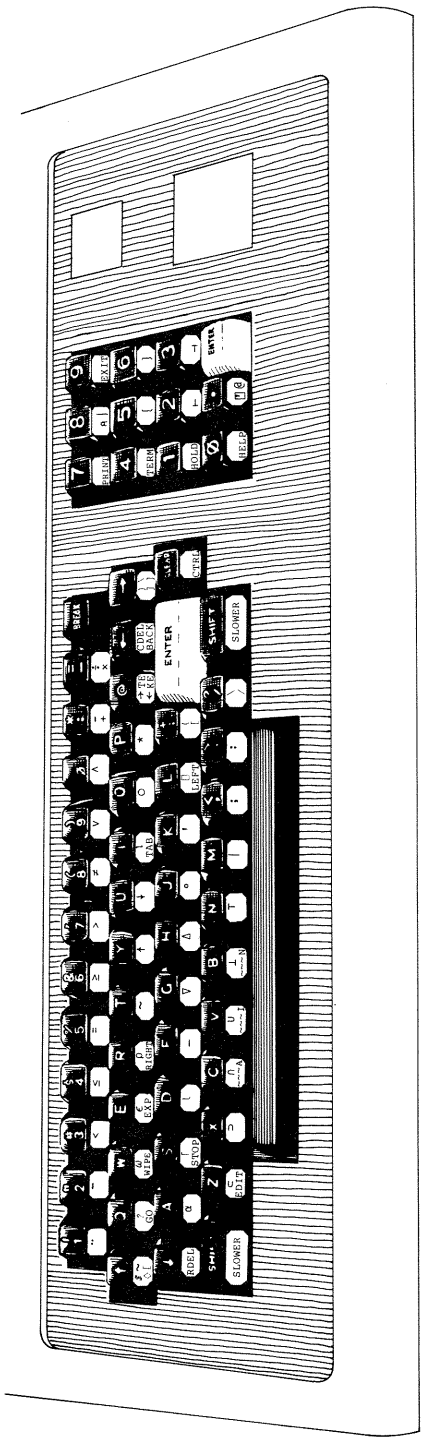


Figure 2.1 The Keyboard

APL CHARACTER SET LABELS

Now that you have applied your APL character set labels and verified that the labels are in the correct positions, you need to understand how the characters are organized on the labels.

alphabetic and numeric characters

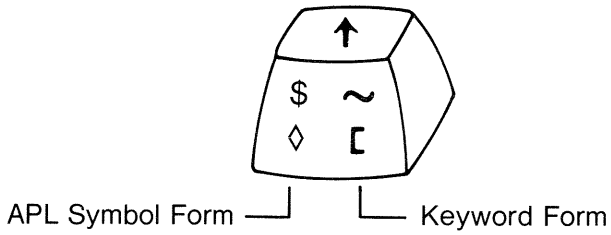
The first thing you'll probably notice is that the labels don't show any alphabetic or numeric characters. Since APL*PLUS/80 and TRSDOS use the same keys to produce alphabetic and numeric characters, you can simply refer to the key tops when you want to type an alphabetic or numeric character.

color-coded keys

You'll also notice that some portions of the labels are color coded. Any symbol in a label portion that is color coded must be created with the CTRL key. For example, to use the WIPE key to clear the display screen, you must hold down the CTRL key while pressing the WIPE key. (You'll learn more about using the CTRL key in the section "Keyboard and Display Control Codes" which begins on page 26).

keys with different uses

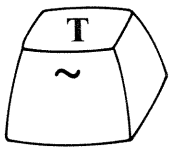
Five APL character set labels have characters side-by-side. For example,



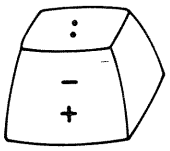
You should always refer to the characters on the left side of the label unless you are using Keyword Form, when you will refer to the characters on the right side of the label. (See the APL*PLUS/80 Programmer's Reference Manual for more information on Keyword Form.)

SHIFTED AND UNSHIFTED CHARACTERS

Most keys have two symbols -- an uppercase symbol (which you'll get when you use the key in combination with the SHIFT key) and a lowercase symbol (which you'll get when you use the key alone). The uppercase symbol always appears on the APL character set label, but the lowercase symbol appears on the label only when it is different from the symbol on your key top. For example,



Uppercase = ~
Lowercase = T



Uppercase = –
Lowercase = +

Alphabetic APL characters are normally displayed in uppercase roman font; for example, A B C D E. However, alphabetic APL characters with an underbar (SHIFT F) are displayed in lowercase roman font. For example, if you type A B C D E the display screen will show:

a b c d e

Before reading any further, try typing a few characters on your keyboard. For example, type an underbar (hold down the SHIFT key and press the F key), then type NORMAL. Notice that the screen displays NORMAL in uppercase roman font. Press the SPACE bar (on the bottom of the main keyboard) once or twice to move the cursor (the thick, blinking underline) one or two positions to the right and type UNDERBAR. These characters are also displayed on your screen in uppercase roman font. Press the BACK key eight times to move the cursor under the U, then type eight underbars (hold down the SHIFT key and press the F key eight times). Notice that the screen now displays UNDERBAR in lowercase roman font.

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> NOTE
>
> As you proceed through the chapters in this manual you'll be doing many exercises on your TRS-80 Model III.
>
> We're sure you'll try to follow the directions carefully, but if you do make a typing error simply press the BREAK key; the line you typed will disappear and you can start over.

NUMERIC PAD

To the right of the main keyboard your TRS-80 has a small section with twelve keys. This section is called the numeric pad. The keys on the numeric pad produce the same characters as the numeric keys on the top row of the main keyboard -- even when you use the numeric keys in conjunction with the SHIFT key or the CTRL key. For example, pressing the 4 key on either the numeric pad or the main keyboard produces a 4; holding down the SHIFT key and pressing the 5 key on either the numeric pad or the main keyboard produces an equals sign; holding down the CTRL key and pressing the 6 key on either the numeric pad or the main keyboard produces a right brace (}).

Before reading any further, try using both the numeric pad and the numeric keys on the main keyboard. For example, move the cursor several spaces to the right (using the SPACE bar) and type 2356 using the numeric pad. Now move the cursor several more spaces and type 2356 using the numeric keys on the main keyboard. Notice that both entries look the same on the display screen.

Space over a few more positions and, while holding down the SHIFT key, use the numeric pad to type 2356. Space over again and repeat the procedure using the numeric keys on the main keyboard. Notice that both entries displayed: $\bar{}$<=≥. (If the Radio Shack Character Generator Chip is still installed, your display screen will show: ¨<=≥. For more information on character display, see Appendix A in the APL*PLUS/80 Programmer's Reference Manual.)

Finally, try the same procedure while holding down the CTRL key. Type 2356 on the numeric pad, space over a few positions, then use the numeric keys on the main keyboard to type the same numbers. Again, both methods displayed the same characters; that is, ⊢⊣{}. (If the Radio Shack Character Generator Chip is still installed, the ⊢⊣ will display as two different characters.)

Although the numeric keys on the numeric pad and the main keyboard are equivalent, we recommend that you use the numeric pad rather than the numbers on the main keyboard when you are using them with the CTRL key. When you use the numeric pad you are less likely to accidentally press an adjacent key that could produce undesirable results.

SPECIAL KEYS

Certain keys on the APL keyboard perform special functions. These keys and their functions are:

- BACK -- Moves the cursor one position to the left (unless the cursor is in position 1 -- at the left margin -- on the first line of an input entry).
- BREAK -- Discards and erases everything from the beginning of the current line to the bottom of the display screen (except the status line).
- CTRL -- Holding down the CTRL key (CLEAR on the key top) while pressing a printing key creates a control character. For further information on control codes, see the section "Keyboard and Display Control Codes" on page 26. For a complete listing of control codes and what they do, see Appendix D. A more detailed listing is provided in the Appendixes in the APL*PLUS/80 Programmer's Reference Manual.
- ENTER -- Signals the end of typing for the current entry and tells the computer to process the entry.
- KE -- Shifts into or out of Keyword Entry to automatically complete (if possible) a keyword. (Used only when in Keyword Form. See the APL*PLUS/80 Programmer's Reference Manual for more information on Keyword Form.)
- RDEL -- Deletes the remainder of the input, and erases everything from the cursor to the bottom of the display screen (except the status line).

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- SHIFT -- Holding the SHIFT key while pressing a key with two symbols produces the upper symbol on the key.

- SLOWER -- If held down during output, displays output more slowly.

- TE -- Shifts into or out of Text Entry (when in Keyword Form), in which you can use the SHIFT key just like you would on a typewriter to produce upper- and lowercase letters. (See the APL*PLUS/80 Programmer's Reference Manual for more information on Text Entry.)

Before reading any further, try using a few of the special keys. In previous exercises you've used three of the special keys (SHIFT, BACK, and CTRL) in displaying information on the screen. The line of information on your display screen should look something like:

```
_NORMAL underbar 2356 2356 ⍁<=≥ ⍁<=≥ ⊢⊣{} ⊢⊣{}
```

Press the BACK key until the cursor is near the center of the line, then press the RDEL key. Notice that everything from the cursor to the bottom of the screen (except the status line) disappears. Now press the BREAK key; the entire line disappears. Type 1 + 4 and press the ENTER key. The computer processes the line, and in this case prints the result of this arithmetic expression. (You'll learn why this happens in APL Is Easy.)

CHARACTER REPEAT

Every key on the keyboard that displays a character on the screen (except when used with the CTRL key) has an automatic character repeat feature. Holding down any printing key for about 1/2-second produces a sequence of the character; that is, the character displays over and over again.

Automatic character repeat is especially useful for moving the cursor quickly to the right using the SPACE bar (fast-forward spacing), and for moving the cursor quickly to the left using the BACK key.

> IMPORTANT NOTE
>
> Experienced APL programmers should note that the delay and speed of repetition are adjustable (see Appendix C in the APL*PLUS/80 Programmer's Reference Manual for details).

Experiment with the automatic character repeat feature before reading the next section. (Remember, you can use the BREAK key to erase everything from the current line to the bottom of the screen.)

KEYBOARD AND DISPLAY CONTROL CODES

In the APL*PLUS/80, control codes are used to either display an additional APL symbol or alter the APL*PLUS/80 environment. For instance, if you hold the CTRL key and press the 3 key, a right-tack symbol (⊣) displays on the screen. Therefore, CTRL 3 produces an additional APL symbol that's not otherwise available on the keyboard. Another example is the HELP key, CTRL 0, which moves you into the APL*PLUS/80 HELP facility and displays a list of topics for which information is available. For more information on the HELP facility, see the APL*PLUS/80 Programmer's Reference Manual.

For a complete listing of available APL*PLUS/80 control codes and what they do, see Appendix D or refer to the adhesive placard of APL*PLUS/80 fingertip controls that you applied to the area between the video display screen and the keyboard of your TRS-80. A more detailed description of APL*PLUS/80 control codes is provided in the APL*PLUS/80 Programmer's Reference Manual.

If there is any information on your display screen, try using the WIPE key, CTRL W, to "wipe" the screen clear.

CHAPTER 3

THE VIDEO DISPLAY

Chapter 3 contains information about the display screen -- what you'll see displayed and how you can change the display. After reading this chapter you'll know:

- the APL*PLUS/80 System characteristics, screen display, and APL character set
- about the status line, cursor, six-space indent, and tab stops.

SCREEN SIZE

The display screen on your TRS-80 measures 12 inches diagonally, and contains 16 horizontal lines that can display up to 64 characters per line (see Figure 3.1).

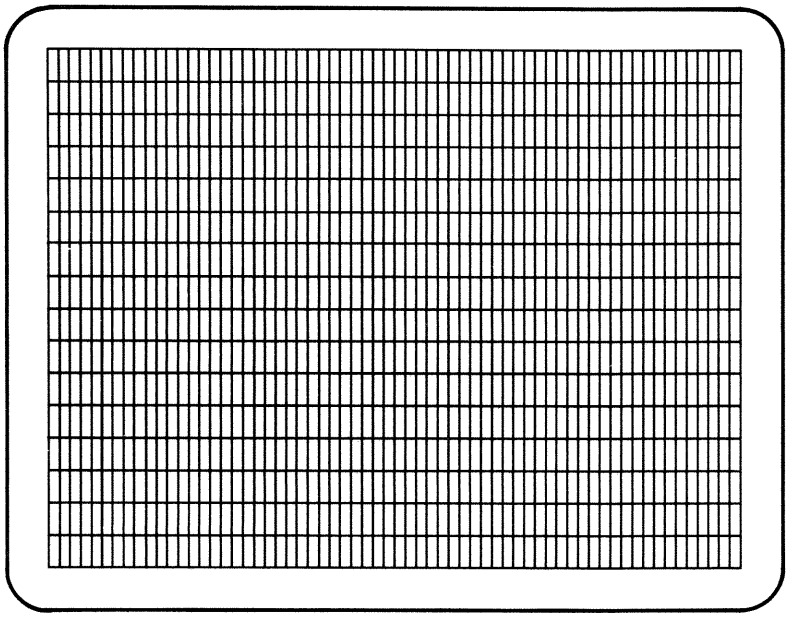

Figure 3.1 The Display Screen

CHARACTER SET

Your TRS-80 can display more than just alphabetic and numeric characters. The APL*PLUS/80 character set includes special characters and graphics characters. To see all the characters in the APL*PLUS/80 character set and learn more about special characters and graphics characters, type:

)LOAD CHARSET

and press the ENTER key. For a complete list of APL characters, you can also refer to Appendix A in the APL*PLUS/80 Programmer's Reference Manual.

STATUS LINE

You'll notice that the last horizontal line on your display screen often shows a wavy line. This line, which consists of 64 tildes (~), is called the status line. The status line displays notes that give you information about the system; for example, TERMINAL, TEXT, EXPAND, KEYWORD, PRINT, HOLD, UNKNOWN OVERSTRIKE, UNKNOWN KEYWORD, KEYWORD COMPLETE, OPEN QUOTE (see Figure 3.2).

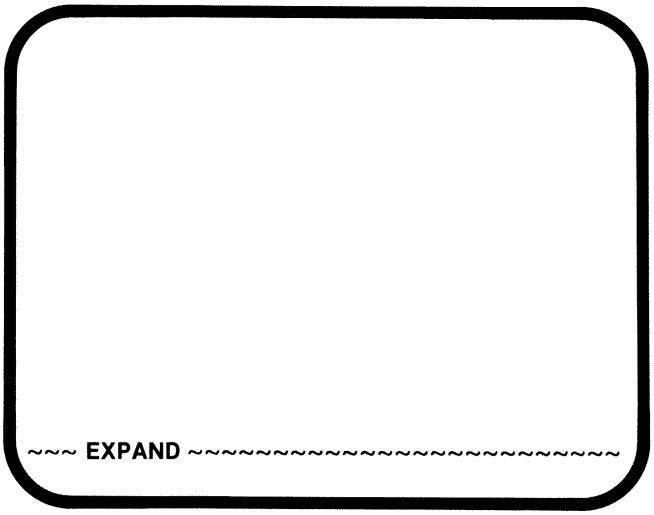

Figure 3.2 Sample Status Line

You'll learn more about status line notes and why they appear in Chapter 4, "Keyboard Entry Editing."

CURSOR

In the exercises presented in Chapter 2 you learned how to display characters on the screen and how to use backspacing and underbars to create lowercase characters. During these exercises, we referred several times to a thick underline called the cursor. The cursor indicates your current position on the display screen; that is, it indicates where the next character you type will appear on the display screen. The cursor usually appears as a thick, blinking underline. However, if you move the cursor to a position that is already displaying a character, the display screen alternates between blinking the cursor and blinking the existing character.

Try the following exercise (and be sure to watch what the cursor does). Find the cursor on your display screen and type a quote (hold the SHIFT key and press the K key). Notice that the quote replaces the cursor and the cursor moves one position to the right. Now type *HI* and backspace once. The display screen alternately blinks the cursor and the I. Hold the SHIFT key and press the F key to produce an underbar. The I now displays as the lowercase letter i. Now type another quote and your display screen should show 'Hi'.

SIX-SPACE INDENT

Let's take our previous example one step further. Press the ENTER key. Your computer talked back to you! But there is one major difference between the 'Hi' that you entered and the Hi that your computer returned to you -- your entry is indented six spaces from the left margin, but the computer response begins at the left margin. Whenever you're in immediate execution input mode or evaluated input mode you'll be able to distinguish your entries from system responses by the six-space indent. (To learn about the modes of operation, see the APL*PLUS/80 Programmer's Reference Manual.)

TAB STOPS

Your APL*PLUS/80 has tab stops preset at every eighth position on the line; that is, in positions 1, 9, 17, 25, 33, 41, 49, and 57. Use the TAB key (CTRL I), just as you would use the tab key on a typewriter, to move the cursor to the next tab stop.

When you want to move the cursor more than eight positions you can use the TAB key several times, or you can simply hold down the SPACE bar to move the cursor quickly to the right.

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Before reading any further, try to display a 1 in position 9, a 2 in position 17, and your first name at a position you choose on the right side of the screen (using the SPACE bar). You can then clear the screen using the WIPE key.

CHAPTER 4

EDITING KEYBOARD ENTRIES

Chapter 4 contains information on the various methods you can use to correct your typing errors, and explains the two messages that APL*PLUS/80 displays to alert you to specific typing errors. After reading this chapter you will not only understand how to use the seven input editing commands to correct your typing errors, but you will also learn the entry editing diagnostic messages, what causes them to appear, and how to correct the problems.

INPUT EDITING COMMANDS

In Chapter 1 you learned that you can correct a typing problem during the TRSDOS start-up dialog by pressing the backspace key (← on the key top) until the cursor erases the incorrect character and then typing the correct information. But, unless you're in APL*PLUS/80's Keyword Form, you can't backspace and retype to correct a typing problem like you did in TRSDOS. APL*PLUS/80 does, however, provide you with seven different methods that you can use to correct typing problems. These APL*PLUS/80 input editing commands give you much more flexibility, and can often save you the time you would spend retyping information if you were using TRSDOS. The seven input editing commands are explained in the following sections.

> IMPORTANT NOTE
>
> The following input editing commands may not work properly in terminal mode. If you will be using your TRS-80 to access a remote computer, you should refer to documentation for the remote computer to learn its input editing commands and their behavior.

Backspace

A backspace, created by pressing the BACK key (the key with BACK printed on the adhesive APL keyboard label), moves the cursor one position to the left without deleting any characters that are on the line. If you hold down the BACK key, the cursor will move quickly to the left until you release the key or until the cursor reaches column 1 of the current line.

Try using the BACK key. Type your full name, then press the BACK key once. The cursor moves one position to the left and the display screen alternately blinks the cursor and the letter above it. Now hold down the BACK key for a second; the cursor moves quickly to the left and stops when you release the BACK key. Press the BACK key again and hold it down; notice that the cursor stops in column 1 even though you haven't yet released the BACK key. Release the BACK key and take a good look at your display screen. Where's the cursor? It's in column 1, six spaces to the left of your name. (Remember, information that you enter is indented six spaces.)

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But how can we call backspace an input editing command if it doesn't change any information? Actually, it does -- if you are editing information in Keyword Form, where words are used in place of APL symbols. In Keyword Form you can move the cursor under the incorrect character and type over the incorrect character to replace it -- just like you can in TRSDOS. But, in APL Symbol Form, you must use backspace in combination with character delete or line expansion to correct typing problems. (You'll find examples in the sections that follow.)

Character Delete

Character deletion, performed with the CDEL key (hold the CTRL key and press the BACK key), deletes the character above the cursor. Any characters to the right of the cursor shift to the left to fill the space. If there aren't any characters above or to the right of the cursor, the cursor moves one position to the left and any character in that position disappears. Whew! Let's try an example. Clear the display screen using the WIPE key (CTRL W). Type:

I'M CONFUSED

and press the CDEL key (CTRL BACK) once; the cursor moves one position to the left and the D disappears. Your display screen now shows:

I'M CONFUSE

Use the BACK key to move the cursor under the apostrophe ('), then press the CDEL key (CTRL BACK) once; the apostrophe disappears and M CONFUSE moves to the left to fill the space. Your display screen now shows:

IM CONFUSE

Watch the display screen closely and use the CDEL key to delete M CONFUSE (hold the CTRL key and press the BACK key nine times). You can now press the SPACE bar once and type:

UNDERSTAND

Your display screen now shows:

```
I UNDERSTAND
```

Let's take the example one step further by using automatic character repeat. Hold the CTRL key and hold the BACK key; character deletion repeats and continues until you release the keys or until the cursor reaches column 1 of the current line.

Line Expansion

The EXP key (CTRL E) shifts a line into or out of line expansion, so that characters you type are inserted above the cursor, and anything already above or to the right of the cursor shifts to the right to make room for the insertions. For example, use the WIPE key to clear the display screen and type:

APLPLUS/80 SYSTEM

Since there should be a star between APL and PLUS, use the BACK key to position the cursor under the P in PLUS; the display screen alternately blinks the cursor and the P. Now use the EXP key (CTRL E) to shift into line expansion (note that EXPAND now displays on the status line), and type a star (hold down the SHIFT key and press the P key). The star is inserted above the original cursor position, and PLUS/80 SYSTEM shifts to the right to make room for the insertion. The display screen now shows:

```
APL*PLUS/80 SYSTEM
```

Also notice that the cursor remains under the P in PLUS, and that the display screen continues to alternately blink the cursor and the P.

Let's try to change our entry from APL*PLUS/80 SYSTEM to APL*plus/80 SYSTEM. Since the cursor is already in position (under the P in PLUS), type an underbar (hold the SHIFT key and press the F key). Oops! The display screen now shows:

```
APL*_PLUS/80 SYSTEM
```

but we wanted APL*plus/80 SYSTEM. This points out an important rule to remember -- to produce a lower case letter using underbar (or to create any overstruck character), you must first shift out of line expansion.

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Before proceeding, let's get rid of the unwanted underbar. Use the BACK key to move the cursor below the underbar, and then the CDEL key to erase the unwanted underbar and shift PLUS/80 SYSTEM back one position to the left. You can now press the EXP key again to shift out of line expansion, and then use underbars to change PLUS to plus. Your display screen should now show:

```
APL*plus/80 SYSTEM
```

> NOTE
>
> Pressing the ENTER key or the BREAK key also turns off line expansion.

Take a few minutes to become more comfortable with using backspace and line expansion to edit keyboard entries. For example, change APL*plus/80 SYSTEM back to APL*PLUS/80 SYSTEM; then change APL*PLUS/80 SYSTEM to APL*PLUS/80 System.

Cursor Movement

In Chapter 2 you learned that control codes are used to either display an additional APL symbol or alter the APL*PLUS/80 environment. But you can also use control codes when you are editing keyboard entries. As described below, CTRL L, CTRL R, and CTRL I move the cursor.

The LEFT key (CTRL L) moves the cursor to the extreme left (the first column) of the current line. For example, wipe the display screen (use the WIPE key) and type:

```
      CONTROL CODES MOVE THE CURSOR
```

Now let's add the word THREE to the front of the line. Use the LEFT key (CTRL L) to move the cursor to the extreme left, and type:

```
THREE
```

The display screen now shows:

```
THREE CONTROL CODES MOVE THE CURSOR
```

The RIGHT key (CTRL R) moves the cursor to the extreme right (just past the last character that is displayed on the current line). Let's add a space and two dashes to the end of our example. Use the RIGHT key (CTRL R) to move the cursor to the extreme right; then press the SPACE bar once and the dash key (SHIFT +) twice. The line should now look like:

```
THREE CONTROL CODES MOVE THE CURSOR --
```

The TAB key (CTRL I) moves the cursor to the next tab position. (Remember, tab stops are preset at every eighth position on the line.) To finish our example, use the TAB key (CTRL I) to move the cursor to the next tab position, and type:

```
                                        L,R,I.
```

Our line now reads:

```
THREE CONTROL CODES MOVE THE CURSOR -- L,R,I.
```

The RDEL Key

In Chapter 2 you learned that certain keys on the APL keyboard perform special functions. The RDEL key (the key with ↓ on the key top) is a special key that deletes the remainder of the input line, and erases everything from the cursor to the bottom of the screen (except the status line).

Let's use the RDEL key to edit the control code example that's already on your display screen. Move the cursor under the first dash (use the BACK key) and press the RDEL key. Notice that, in this case, everything from the cursor to the end of the line disappears, but the status line is still displayed at the bottom of the screen.

The BREAK Key

The BREAK key, another special key, erases and discards everything from the beginning of the current line to the bottom of the screen (except the status line). Again using the control code example that's on your display screen, press the BREAK key. The entire line disappears, but the status line remains at the bottom of the display screen.

Statement Recall

You've already learned a number of ways to correct a line before you've pressed the ENTER key. But what can you do if you press the ENTER key and then realize that the line of information your computer processed was not really what you wanted? Do you retype the entire line?

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That's one way to do it, but if the statement you typed was long or complex, the first thing you'll probably do is wish that you hadn't pressed the ENTER key! Your wish comes true when you use something we call statement recall. Just type a right parenthesis,), and press the ENTER key, and the statement you typed will reappear on the display screen with the cursor at the extreme right (just past the last character displayed on the line). Try it. Type:

```
      1+5
```

and press the ENTER key. The computer processes the line and displays the result:

```
6
```

Perhaps what you really wanted to enter was 1+5+7. Type:

```
      )
```

and press the ENTER key to recall the statement. Notice that the cursor is at the extreme right, so you can simply type +7 to add to the end of the original line. Your statement now reads:

```
      1+5+7
```

Press the ENTER key and your computer displays the result --

```
13
```

If you now decide that you want to add 1, 3, 5, and 7 with the numbers in ascending order, do you retype the entire line? Do you use statement recall and then backspaces so that you can insert +3 in the statement?

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Both of these methods will work, but there is an easier way. If you type) followed by a number, the statement you typed reappears on the display screen with the cursor in the position number you've specified. For example, type:

```
      )8
```

and press the ENTER key. Your last statement,

```
      1+5+7
```

reappears on the display screen, and the cursor is in position 8 -- under the first +, eight spaces from the left margin. You can now turn on line expansion (using the EXP key), type +3 to edit the line, and press the ENTER key to process the statement:

```
      1+3+5+7
16
```

You should note that the EDIT key (CTRL Z) works exactly like typing a) -- the statement you typed reappears on the display screen with the cursor at the extreme right.

> IMPORTANT NOTE
>
> Experienced APL programmers should note that statement recall is only available in immediate execution mode and evaluated input mode.

ENTRY EDITING DIAGNOSTICS

So far we've seen that APL*PLUS/80 allows you to edit entries, and that when you press the ENTER key, APL*PLUS/80 will process the statement you've typed. But if you type information that APL*PLUS/80 can't work with, the status line will display one of two messages to alert you to specific problems -- UNKNOWN OVERSTRIKE or OPEN QUOTE.

Unknown Overstrike

An overstruck character is one that is formed by using the BACK key to superimpose one character on top of another. For example, in several exercises in Chapter 2 you created an overstruck character by using an underbar to change an uppercase character to lowercase. But even more importantly, you created a "legal overstrike" -- a combination of symbols that was recognized and could be processed by APL*PLUS/80.

Let's try to type some overstruck characters. Type a ⌂ (SHIFT C), backspace once, and type a ∘ (SHIFT J). The character you've formed is called the lamp symbol (⍀) and it is a legal overstrike. Now type 1, backspace once, and type an underbar (SHIFT F). The display screen flashes a "checkerboard" pattern, the characters you tried to type disappear from the display screen, and the status line now displays the message UNKNOWN OVERSTRIKE. APL*PLUS/80 is alerting you that you typed an overstrike that it doesn't recognize. You can now enter information as though you'd never made the entry. As soon as you type a character, that character displays on your screen and the UNKNOWN OVERSTRIKE message disappears from the status line.

> NOTE
>
> Experienced APL programmers should note that:
>
> - The UNKNOWN OVERSTRIKE message does not appear in Keyword Form.
> - In other APL systems, the UNKNOWN OVERSTRIKE message does not itself appear, but is grouped into a larger category of error messages called CHARACTER ERROR or INPUT ERROR.

It's interesting to note that the BACK key can be used with UNKNOWN OVERSTRIKE to edit entries. Let's see how it works. Use the WIPE key to clear the display screen and type:

*APL*PLUS*-80 *IS EASY TO LEARN*

We can use UNKNOWN OVERSTRIKE to change the dash to a slash so our corrected entry will be APL*PLUS/80 IS EASY TO LEARN. Use the BACK key to move the cursor under the dash, then type a numeric character from 1 to 9. Since no legal overstrike on the APL*PLUS/80 System is formed with these numeric characters, the screen flashes, the dash disappears, and UNKNOWN OVERSTRIKE appears in the status line. Now, simply type a slash and your corrected entry will read:

APL*PLUS/80 IS EASY TO LEARN

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Open Quote

Another message that appears in the status line to alert you to a problem is OPEN QUOTE. Let's go back to an exercise you did in Chapter 3. Use the WIPE key to clear the display screen and type:

```
'HI'
```

and press the ENTER key. The computer responds with:

```
HI
```

APL*PLUS/80 simply repeats the statement that you enclosed in quotes. Now type:

```
'HI
```

and press the ENTER key. The display screen flashes a "checkerboard" pattern, and the status line now displays the message OPEN QUOTE. APL*PLUS/80 is alerting you that didn't type two (or a multiple of two) quotes, and that it can't process the line until you type an even number of quotes. In this example, type a quote after the I; the OPEN QUOTE message will disappear from the display screen and you can now press the ENTER key.

> NOTE
>
> Experienced APL programmers should note that:
>
> - The OPEN QUOTE message does not appear in character input mode.
> - The OPEN QUOTE message does not appear if there are unmatched quotes after a lamp symbol.

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CHAPTER 5

SYSTEM SHUT-DOWN

Chapter 5 contains information on how to properly shut down your TRS-80. You will not only learn the proper system shut-down steps, but you'll also learn why performing these steps is so important.

SHUT-DOWN STEPS

When you are finished working with your computer you must perform four shut-down steps. The four shut-down steps, described below, are:

- o save your data and programs
- o end the current APL session
- o remove all disks
- o power-off your peripheral devices and TRS-80.

Save Your Data and Programs

Information that you store during a session with your TRS-80 is saved in the computer's memory. But when you turn off the computer, its memory (like the memory of many calculators) is erased. This may not be a problem if you've only stored one or two items that can easily be reentered the next time you use your computer. But, more often than not, you'll find that you've stored many programs and data items that you'll want to use later.

To save information for later use, use the)SAVE command. Since you must be able to later identify the information so you can retrieve it, you'll need to give the set of information a name. Simply type)*SAVE*, press the SPACE bar once, type the name that you want to use to identify the information, and press the ENTER key. (You'll learn more about storing information, saving information, and recalling information in APL Is Easy.)

For example, you could type:

```
)SAVE PARTONE
```

When you pressed the ENTER key, your display screen would then show something like:

```
1 PARTONE SAVED 05/22/82 16:41:25 WA=19682 ...
```

> NOTE
>
> Remember, since you must be able to later identify the information so you can retrieve it, you should also label the disk in disk drive 1 with the name you used when you saved the information.

At the beginning of the next session, you can retrieve stored information using the *)LOAD* command. Just type *)LOAD*, press the SPACE bar once, type the name you used when you saved the information, and press the ENTER key. Continuing with our previous example, you could type:

```
)LOAD PARTONE
```

When you pressed the ENTER key, your display screen would then show something like:

```
1 PARTONE SAVED 05/22/82 16:41:25 WA=19682 ...
```

Your system displays this line to confirm that the information has been "loaded" into your computer's memory. Notice that the information in this line is exactly like the information in the line that was displayed when you used the)SAVE command.

End the Current APL Session

After you save your data and programs, you must end your APL session by typing *)OFF* and pressing the ENTER key.)OFF doesn't save any information, but it does close any files that are still open and return you to the TRS-80 operating system, displaying "TRSDOS Ready" (or "LDOS Ready").

Remove All Disks

Next, you should remove all disks from your built-in and external disk drives. When removing a disk, lift the drive latch, carefully pull the disk out of the disk drive, replace the disk in its protective storage envelope, and store it in an upright position.

Power-off Your Peripherals and TRS-80

Turn off all peripheral devices (such as external disk drives and printer); then flip the power switch to turn off your TRS-80.

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SUMMARY OF SHUT-DOWN STEPS

Remember, when you are finished working with your computer you should:

- Save any information you want to use later on a data disk by typing *)SAVE*, pressing the SPACE bar once, typing the name that you want to use to identify the information, and pressing the ENTER key.
- End your APL session by typing)OFF and pressing the ENTER key.
- Remove all disks from your built-in and external disk drives, place the disks in their protective storage envelopes, and store the disks in an upright position.
- Turn off all peripheral devices (such as external disk drives and printer) and your TRS-80.

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CHAPTER 6

SAMPLE APL SESSION

Chapter 6 reviews the steps necessary to begin an APL session and end an APL session, and explains how to run a stored program. Within the chapter we have provided examples of what you might see on your display screen as you proceed through the various steps. As you read this chapter you should actually restart your computer, run the stored program following the steps provided, and then shut down your computer. After reading this chapter you will be ready to read APL Is Easy and begin experimenting with APL.

START-UP STEPS

As you learned in Chapter 1, before you can begin working with APL you must perform a number of start-up steps. Restart your computer now by performing these start-up steps:

- Be sure that the computer is plugged in.
- Turn on all peripheral devices (such as external disk drives and printer).
- Open the drive latch on disk drive 0, carefully insert the APL*PLUS/80 system disk into the disk drive, and close the drive latch.
- Insert other formatted disks you want to use, if any, into disk drives 1, 2, and 3.
- Flip the power switch to turn on the computer, then wait until the disk drive motors stop.
- Adjust the display screen brightness and contrast.
- Using the standard TRS-80 keyboard (the symbols on the key tops), enter the current date and time. Your display screen will show something like:

```
Enter Date (MM/DD/YY)? 03/01/82
Enter Time (HH:MM:SS)? 14:15:00
TRSDOS Ready..............
```

- Type *APL* and press the ENTER key. (Note that this step is not necessary if you have executed the AUTO APL command in a previous session.) Your display screen will show:

```
APL
```

RUN A STORED PROGRAM

To give you experience in retrieving and running a stored program, we have included a special program on your APL*PLUS/80 system disk. This program is stored under the name DEMO. When you run the program, it describes (on your display screen) what kinds of things you will see and what you must do to make the program run properly. Run the DEMO program now by typing *)LOAD DEMO* and pressing the ENTER key. Your display screen will show something like:

```
      )LOAD DEMO
0 DEMO SAVED 04/12/82 17:35:21 WA=21903...
```

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SHUT-DOWN STEPS

When you are finished working with your computer you must perform four shut-down steps. Shut-down your computer now by performing these shut-down steps:

- Save your information on a data disk by typing *)SAVE*, pressing the SPACE bar once, typing the name that you want to use to identify the information and pressing the ENTER key.

```
      )SAVE FIRST
1 FIRST SAVED 06/12/82 10:26:04 WA=22861...
```

- End your APL session by typing *)OFF* and pressing the ENTER key. Your display screen will show:

```
TRSDOS Ready..............
```

- Remove all disks from your built-in and external disk drives, place the disks in the disk envelopes, and store the disks in an upright position.

- Turn off all peripheral devices (such as external disk drives and printer) and your TRS-80.

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CHAPTER 7

USER RESPONSIBILITIES

Chapter 7 contains information on various "housekeeping" duties that you should perform. These duties include: cleaning, formatting, and making back-up copies of disks; compressing data files; and designing file storage.

People who use a time sharing terminal connected to a large computer depend on the computer operations staff to maintain the computer, provide back-up, and perform other "housekeeping" functions needed to ensure smooth operation. In contrast, a person who uses a self-contained computer such as the TRS-80 Model III not only receives the benefits of total control and availability of the computer, but also has the operations responsibility for it.

CLEANING DISK DRIVES

Disk drives are a lot like tape recorders; they must be kept clean or the results may be less than perfect. You should purchase a disk cleaning kit and use it as instructed every two to four weeks.

FORMATTING NEW DISKS

Before using a new disk to store information, you must format the disk. This simple procedure, which uses the TRSDOS FORMAT command, is described in detail in the TRS-80 Model III Disk System Owner's Manual (or in the LDOS User's Manual).

We suggest that you always keep several formatted disks on-hand in case they are needed unexpectedly. For example, if your current disk becomes full you will need to insert a new formatted disk. If you have to end your APL session to format a disk, you'll lose the information stored in the computer's memory. So, we repeat: Always keep several formatted disks on hand.

MAKING BACK-UP COPIES OF DISKS

The process of copying all of the data files from one disk to another is called back-up. As the name suggests, having a duplicate copy of your data files on a second disk protects you in case data on one of the disks is lost or damaged because of a computer malfunction or human error. Problems that can damage your disks can include anything from spilling coffee on your disk, to small children finding the disk a new and interesting playtoy, to the failure of an electronic device. Data can also be lost by inadvertently executing the wrong system command or even misspelling a file name.

A good rule to remember is that you should never use your only copy of an important disk -- except to make a back-up copy.

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The procedure for making a back-up disk is described in detail in the TRS-80 Model III Disk System Owner's Manual (or in the LDOS User's Manual). However, you may remember that you made back-up copies when you created your APL*PLUS/80 system disk. In summary, to make a back-up copy:

- When TRSDOS displays "TRSDOS Ready", type *BACKUP* and press the ENTER key. TRSDOS loads and starts a program called BACKUP, and asks you to enter the source drive number. Type the number of the disk drive that contains your original disk and press the ENTER key.

- If the disk you want to back up is not the APL*PLUS/80 system disk, you can now remove the APL*PLUS/80 system disk from disk drive 0, and insert the disk you want to back up in disk drive 0.

- After you enter the source drive number, TRSDOS asks you to enter the destination drive number. Type the number of the disk drive that contains the new, blank disk that will become your copy, and press the ENTER key.

- TRSDOS now asks you to enter the source disk master password. Type *PASSWORD* (or, if you've changed it, the password that you've assigned to your source disk) and press the ENTER key. TRSDOS will now copy everything from the original disk to the new, formatted disk.

- When the copying process is complete, remove your original disk, insert it in the disk envelope, and store it in a safe place. Remove the back-up copy you have just made of your original disk, and insert it in the disk envelope. Using a felt-tip pen to write gently on the disk label, identify the disk, and store it in a safe place.

COMPRESSING DATA FILES

If you're just learning to use APL, the idea of compressing (or "compacting") data files may be somewhat confusing; you may want to skip over the information in this section. However, this information is important to people who use programs that have data files with "expanding" component replacements; that is, replacement components (records) which, when rewritten to the disk, are larger than the original components. Data file compression is also important to people who use programs that drop components from files. Each of these normal processes leaves unused file space that cannot be used again unless you compress the file.

If you are running an application program package that was written by someone else, compression of data files is probably built into the package. All you need to do is follow the documentation provided with the application package. However, you should verify that compression is not only incorporated into the package, but also that it is necessary.

If you do need to compress your data files, the procedure is explained in detail in the APL*PLUS/80 Shared File System User's Guide and the APL*PLUS/80 Programmer's Reference Manual. (Note that after you have compressed the data files on a disk you should make a back-up copy of the disk.)

FILE SIZE DESIGN

It is possible for you to create a file that becomes so large that it can't get any larger. You can compress the file to reclaim unused file space, but only if the amount of available space remaining on a disk in the system is equal to (or greater than) the size of the useful data space in the file. Therefore, you should be careful not to "paint yourself into a corner" by writing programs that don't leave enough space on the disk to allow compression. The actual file size limit depends on many factors, but for a typical TRS-80 Model III with two disk drives, the maximum file size should be 100,000 to 140,000 bytes of useful data space.

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APPENDIX A

CHARACTER GENERATOR INSTALLATION

WHAT THE CHARACTER GENERATOR DOES

One custom APL character generator is supplied with your APL*PLUS/80 System. This "chip", when properly installed in your TRS-80 Model III, provides you with an accurate display of all APL characters.

The APL*PLUS/80 as delivered to you will run without installing the custom APL character generator. Some of the APL characters, such as ⍴ and ⍳, will be displayed correctly. Others will display as characters from the original character set that are similar to the true APL characters. For example, floor (⌊) is a lambda (⍺), take (↑) is a little man (⍤), and the assignment arrow (←) is a wavy equals sign (≈). See Appendix A in the APL*PLUS/80 Programmer's Reference Manual for a complete listing of APL characters.

HOW IT AFFECTS YOUR WARRANTY

Two important issues relating to your TRS-80 Model III warranty should be considered before installing the custom APL character generator.

When you purchase a new TRS-80 Model III, you get a free 90-day warranty. This warranty is voided, however, if you remove the cover of your TRS-80 Model III. After your free 90-day warranty expires you can purchase a service agreement from Radio Shack. Removing the cover of your TRS-80 Model III can also affect your service agreement. At the discretion of your local Radio Shack manager, you may incur an extra charge for your next service call. At the time this publication is being written, Radio Shack also has a policy, to which most managers strictly adhere, against Radio Shack employees installing non-Radio Shack parts or features.

We suggest that you discuss these issues with your local Radio Shack manager and request that a certified Radio Shack technician perform the 20-minute installation of your APL*PLUS/80 custom APL character generator. However, if Radio Shack declines to install the component, the section that follows explains the installation process.

INSTALLATION PROCEDURES

To install the custom APL character generator you will need a Number 2 Phillips screwdriver and a small pocket knife or integrated-circuit puller. Note that sizes of Phillips screwdrivers are not interchangeable; be sure to use a Number 2.

You might like to ask a friend to read the installation instructions to you as you work; you'll find that the installation process will proceed more quickly than it would if you read the installation instructions yourself.

Before starting to install the custom APL character generator, read all the instructions that follow. Plan to carefully record which screw comes from which hole so that you can replace each screw correctly.

1. Select as your work surface a table that is at least five feet wide.

2. Clear off the table and put down several layers of newspaper covering a three-foot square area. This will prevent scratching the paint on the computer's cover when you are sliding your TRS-80 on its side or back.

3. Place your TRS-80 on the table.

4. Remove all cables from the bottom and rear of the computer.

5. Disconnect the power cord from any power source.

6. Place your computer on its back with the bottom facing you.

7. There are nine screws of different types (threads) and lengths around the perimeter of the case bottom and one screw under the sticker that says BREAKING SEAL VOIDS YOUR SERVICE WARRANTY. Before removing these screws, take a sheet of paper, roughly sketch the bottom of the case, and mark the position of each screw.

8. Use a few pieces of tape at the front of the keyboard to hold the top and bottom parts of the case together as you remove the screws.

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9. Remove the ten screws from the case bottom using a Number 2 Phillips screwdriver. As you remove each screw, push it through the paper in the proper location on the sketch you have drawn. Note that when you are removing the two recessed screws from the case, tilting the case forward makes removing the screws easier. (The rubber feet should not be unscrewed from the case bottom.)

10. While holding the top and bottom parts of the case together at the rear of the keyboard area carefully place the computer on its feet (right side up).

11. Remove any tape you have applied at the front of the keyboard; you no longer need to hold the top and bottom parts of the case together.

12. Rotate the computer one-half turn so that its back is facing you. This can easily be done by turning the newspaper under the computer (rather than lifting the computer to turn it).

13. Remove the single screw in the back and place it in the appropriate location on your diagram.

14. Rotate the computer another one-half turn so that the front is again facing you.

15. If you have a light, shine it in the ventilation holes in the top. You'll see that part of the display screen tube sits very close to the back of the case and to surrounding components. You might also note that many of the connecting wires are very short.

16. Move the computer to the right side of your working area so that there is room on the left to place the top part of the case. When lifting the top part of the case, don't allow the end of the display tube to touch the assembly behind it. Very slowly and carefully lift the top part of the case straight up about four inches. (Don't be surprised if it's a little difficult to lift the top part of the case -- the case top and the display screen tube that's attached to it weigh almost 15 pounds.)

17. Look in the opening in the case for the top disk drive; you can see the back of the display screen tube and the wires connecting the top and bottom parts of the computer.

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18. Being very careful not to jolt the display screen tube or pull on the short wires, continue lifting the right side of the case without lifting the left side.

19. Lay the top part of the case on its left side (with the display screen facing you) next to the bottom of the case.

20. While keeping the top case next to the bottom case, turn both assemblies simultaneously one-half turn so that the back of the computer faces you. Again, turning the newspaper under the computer is easier than lifting the computer.

21. The RF (Radio Frequency) shield is a large vertical metal plate that covers the back of the computer. (Earlier models of the TRS-80 Model III do not have an RF shield. If your TRS-80 is one of these earlier models, skip to step 26.) There are five (or possibly six) 1/4-inch screws around its perimeter; the screws have two different kinds of threads -- some have washers and some hold down ground lugs. Before removing these screws, take a sheet of paper, roughly sketch the RF shield, and mark the position of each screw.

22. Remove the five (or six) screws from the RF shield. As you remove each screw, push it through the paper in the proper location on the sketch you have drawn.

23. Near the top left edge of the RF shield a small black prong projects into an opening in the shield, holding the RF shield in place. Locate this pin.

24. Carefully pry the RF shield away from the pin, and move the top of the RF shield toward you.

25. Allow the top of the RF shield to drop down and hinge on the adhesive tape at the bottom of the RF shield. Don't allow the RF shield to rest against any electronic components at the back of the computer.

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26.

IMPORTANT NOTE

Before proceeding with the next step, read the following notes on installing integrated circuits such as your custom APL character generator.

- Integrated circuits (ICs) can be damaged by the static electricity that is easily generated by handling or by storage in non-conductive materials. When not installed in a circuit board, ICs must be stored in protective, conductive material such as the foam supplied with your custom APL character generator. Use this piece of conductive foam to store the original character ROM that you will remove. The original character ROM can be reinstalled in the future if you desire.

- We suggest that before removing the original IC, you note its position in the socket. This is a good indication of the proper position of the correctly installed replacement. The IC may not need to be inserted far enough for the ceramic body to actually touch the socket.

- Excess force while installing or removing an integrated circuit can bend or break off the pins which fit into the socket. Use the minimum force required and apply the force evenly (so that both ends of the IC move at the same rate) or in small amounts at opposite ends of the IC. If a pin is bent it MUST be straightened before you attempt to insert it in a socket or in conductive foam. Use tweezers or needle-nose pliers, with as little force as possible, to straighten the bent pin. If one pin on an IC is bent the pin may break when insertion force is applied. Be very gentle.

- When installing a new IC, you should note that the pins may not be quite perpendicular to the IC case. It is common for the pins to be slightly and uniformly bowed. If the rows of pin tips are too far apart to start easily into the socket, insertion will be easier if you bend the pins slightly so that they are uniformly perpendicular. To ensure uniformity, place the row of pins against the table top and gently press down. If necessary, bend both rows an equal small amount.

- Although ICs appear to be symmetrical, they will NOT work if inserted backward. Both the IC and the socket have a small notch (or dot) on one end. Notice the orientation of the original part before removing it, and when inserting the new IC, be sure that the notch (or dot) on the IC and on the socket are properly aligned.

- Once an IC is correctly started into its socket it may require considerable force to complete insertion. This force will not damage the IC or the socket, but may bend the printed circuit board. Place your thumb or finger next to the socket on the opposite side of the circuit board. Push against the circuit board while pushing on the IC until it is fully inserted. This will balance the force and prevent the damage that might occur if the circuit board is bent.

27. Locate U36, the character generator ROM IC. U36 is located in the upper left quarter of the CPU board (as you face it from the back of the computer). The part number (U36) is written on the printed circuit board above the IC, and the IC itself may have the Radio Shack part number 804-4316 printed on it. U36 is the only 24-pin IC that is mounted horizontally on the CPU board.

28. Using a pocket knife or an IC puller, place the tip of the knife blade 1/8-inch under the end of the IC.

29. Slowly and carefully twist the blade so that the IC rises very slightly (about 1/32 of an inch).

30. Note that as the IC pins rise out of the socket they become easier to lift. Be sure to apply the lifting force so that the IC is removed with the pins on both ends, as well as both sides, rising evenly. Completely removing one end of the IC before starting to lift the other end will bend the pins.

31. Repeat the procedure by alternating ends of the IC until it is free of the socket.

32. Remove the custom APL character generator from its storage container, and from the protective, conductive black foam packing by lifting it straight up. Completely removing one end of this IC from the conductive foam before starting to lift the other end will bend the pins.

33. Align the custom APL character generator with socket U36. This IC should be inserted with the notched end on the right.

34. Start the insertion very gently until all 24 pins are partially inserted into the socket.

35. Place your finger behind the circuit board to brace it.

36. Once the IC is started into the socket, push on it with two or three fingers to distribute the insertion force evenly across the body of the IC.

37. Insert the pins of the original character generator ROM into the protective, conductive black foam supplied with your APL*PLUS/80, and place the foam in its storage container.

38. Store the container in a drawer or other safe place in case you want to reinstall the original chip at some later date.

39. Replace the RF shield using the five (or six) screws that you removed from the shield in step 22. Be certain that you reattach the two ground lugs you removed, and that you return the screws to their original locations.

40. While keeping the top case next to the bottom case, turn the newspaper under the computer (so that both assemblies move simultaneously) until the front of the computer faces you.

41. Very carefully lift the top case and rotate it one-quarter turn to the right, then begin to lower the top case onto the bottom case. Do not allow the end of the display screen tube to touch the assembly behind it and do not pull on the short wires.

42. As you continue to lower the top case, keep the inside back of the case against the back of the RF shield; this provides the maximum clearance between the case and the display screen tube.

43. After you have placed the top and bottom cases together, rotate the computer one-half turn so that the back is facing you.

44. Replace the single screw in the back and rotate the computer one-half turn so that the front of the computer is facing you.

45. Use a few pieces of tape at the front of the keyboard to hold the top and bottom parts of the case together as you replace the other screws.

46. While holding the top and bottom parts of the case together at the rear of the keyboard area, place the computer on its back and replace one of the screws in the bottom case along the front of the computer.

47. Replace the other nine screws in the bottom case. Be certain that you return the screws to their original locations.

48. Place the computer upright on the table and remove any tape you have applied at the front of the keyboard. There should be no parts left over except the original character ROM.

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APPENDIX B

SOFTWARE INSTALLATION INSTRUCTIONS -- TRSDOS

(For use with the TRSDOS operating system supplied by Radio Shack)

In the front inside pocket of your APL*PLUS/80 binder is an APL*PLUS/80 "distribution" disk. The APL*PLUS/80 distribution disk cannot itself run the APL system. It contains only the APL*PLUS/80 system code. It does not contain TRSDOS, licensed to you by Tandy Corporation, which is needed to run the APL system. You must merge the APL*PLUS/80 distribution disk with a TRSDOS system disk, creating an APL*PLUS/80 "system" disk. You will also need to make a second disk for the APL*PLUS/80 workspace and file library. (Note that you will need three blank disks to be able to perform the following steps.)

> CAUTION
>
> If you have never handled disks before, be sure to read about disks and disk drives in Chapter 1, "System Start-Up", before beginning these installation steps.

To install your APL*PLUS/80 system on a pair of working disks:

INSERT DISKS

1. Remove your TRSDOS Version 1.3 system disk (the "source" disk) from the disk envelope and insert the system disk into drive 0 (the bottom disk drive). Insert a new, blank disk (the "destination" disk) into disk drive 1 (the top disk drive). (See Figure 1.4 which illustrates proper disk insertion.)

START UP TRSDOS

2. Turn on your TRS-80 Model III using the power switch which is located under the right side of the keyboard. Flip the power switch to turn on the computer; you'll hear a humming and buzzing sound. The sound is made by the disk drive motors starting. Wait until the disk drive motors stop and the drive select light goes off before proceeding to the next step; the computer is loading and starting the operating system software from the TRSDOS system disk in disk drive 0 and setting the system clock to midnight.

3. After you turn on your TRS-80 and the start-up program determines that everything is working properly, TRSDOS Version 1.3 displays a picture of your TRS-80, the TRSDOS version number and date of creation, and the amount of RAM and number of disk drives in your system. TRSDOS asks you to enter the date in the form MM/DD/YY; For example, 03/01/82 for March 1, 1982. Type the correct date. If you make a mistake while typing, you can correct the problem by pressing the backspace key (← on the key top) until the cursor erases the incorrect character and then typing the correct information. When the date is correct, press the ENTER key. Note that TRSDOS will not allow you to enter an unrealistic date (for example, 13/42/82), and TRSDOS will not continue until you enter a date that's in the proper format (MM/DD/YY).

4. After you enter the date, TRSDOS asks you to enter the time in the form HH:MM:SS. You should enter the time in twenty-four hour format; for example, 14:15:00 for 2:15 p.m. Type the correct time using the standard TRS-80 keyboard to type the colon; that is, press the key with a : on the key top, not with an APL colon on the adhesive label. You can use the correction procedures described in step 3 if necessary. When the time is correct, press the ENTER key. TRSDOS displays "TRSDOS Ready".

MAKE BACK-UP COPY OF TRSDOS SYSTEM DISK

5. Type *BACKUP* and press the ENTER key; TRSDOS loads and starts a program called BACKUP, and asks you to enter the source drive number. Type 0 (since your "source" disk -- the original TRSDOS system disk -- is in disk drive 0) and press the ENTER key.

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6. After you enter the source drive number, TRSDOS asks you to enter the destination drive number. Type 1 (since your "destination" disk -- the new, blank disk that will become your copy -- is in disk drive 1) and press the ENTER key.

7. TRSDOS now asks you to enter the source disk master password. Type *PASSWORD* (PASSWORD is the password of the original TRSDOS system disk) and press the ENTER key. TRSDOS will now copy everything from the original TRSDOS system disk in disk drive 0 to the new disk in disk drive 1.

MAKE MASTER APL*PLUS/80 SYSTEM DISK

8. When the copying process is complete, remove the original TRSDOS system disk from disk drive 0, insert it in the disk envelope, and store it in a safe place. Move the back-up copy you have just made of your TRSDOS system disk from disk drive 1 to disk drive 0. Remove the APL*PLUS/80 distribution disk (it has APL*PLUS/80 System printed on the disk label) from the disk envelope and insert the distribution disk into disk drive 1 (with the disk label facing up).

9. Type *DO COPYAPL* and press the ENTER key. This copies all of the APL system program files from the APL*PLUS/80 distribution disk in disk drive 1 to the TRSDOS system disk in disk drive 0.

10. When the copying process is complete, disk drive 0 will contain your master APL system disk -- a complete system disk for operating APL. Remove the APL*PLUS/80 distribution disk from disk drive 1, insert it in the disk envelope, and set it aside.

MAKE WORKING COPY OF APL*PLUS/80 SYSTEM DISK

11. Place a new, blank disk into disk drive 1 so you can make an extra copy of your new master APL system disk. Type *BACKUP* and press the ENTER key just like you did in step 4; TRSDOS again loads and starts the BACKUP program and asks you to enter the source drive number. Type 0 and press the ENTER key.

12. After you enter the source drive number, TRSDOS asks you to enter the destination drive number. Type 1 and press the ENTER key.

13. TRSDOS now asks you to enter the source disk master password. Type *PASSWORD* and press the ENTER key.

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14. When the copying process is complete, remove the disk from disk drive 0, and insert it in the disk envelope. Using a felt-tip pen to write gently on the disk label, identify this disk as your "master APL*PLUS/80 system disk" and store it in a safe place. Remove the disk from disk drive 1, and insert the disk in the disk envelope. Using a felt-tip pen to write gently on the disk label, identify this disk as your "working APL*PLUS/80 system disk" (which we will refer to as the APL*PLUS/80 system disk throughout this manual).

MAKE APL*PLUS/80 WORKSPACE AND FILE LIBRARY DISK

15. Insert the APL*PLUS/80 system disk in disk drive 0. Insert a blank disk in disk drive 1. Type *BACKUP* and press the ENTER key. TRSDOS loads the BACKUP program and asks you to enter the source drive number. Before answering this question, remove the APL*PLUS/80 system disk from disk drive 0, insert it in the disk envelope, and set it aside.

16. Insert the APL*PLUS/80 distribution disk in disk drive 0 with the label side down. This places the side with the workspace and file library under the disk heads.

17. You can now answer TRSDOS' request for the source drive number. Type 0 and press the ENTER key.

18. After you enter the source drive number, TRSDOS asks you to enter the destination drive number. Type 1 and press the ENTER key.

19. TRSDOS now asks you to enter the source disk master password. Type *PASSWORD* and press the ENTER key.

20. When "Insert SYSTEM Diskette <ENTER>" appears, remove the disk from disk drive 1, and insert it in the disk envelope. Using a felt-tip pen to write gently on the disk label, identify this disk as your "APL*PLUS/80 distribution workspace and file library". Re-insert this disk in disk drive 1. Remove the APL*PLUS/80 distribution disk from disk drive 0, insert it in the disk envelope, and set it aside.

TEST YOUR APL SYSTEM

21. Insert your working APL system disk in disk drive 0 and press the ENTER key.

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22. Test your APL*PLUS/80 System. Press the recessed orange system reset button; you'll once again hear a humming and buzzing sound. Wait until the drive motors stop, the drive select light goes off, and TRSDOS displays "TRSDOS Ready". Type *APL* and press the ENTER key to load the APL*PLUS/80 System. (If you plan to use your computer primarily for APL, you may want to type *AUTO APL* instead of *APL*, and press the ENTER key. This will automatically load the APL*PLUS/80 System whenever you start TRSDOS.) The load process takes about 20 seconds and ends with the cursor (a thick, blinking underline) reappearing.

23. Execute a few APL statements and system commands to verify that your new APL*PLUS/80 system disk is working properly. For example:

    - Type *)LOAD SYSTEST* and press the ENTER key. Your TRS-80 will display a message indicating that the workspace is saved.

    - Type *SYSTEST* and press the ENTER key. Your TRS-80 will display test results. The last line displayed will be TEST FINISHED.

    - Type *)OFF* and press the ENTER key. Remove your APL*PLUS/80 system disk from disk drive 0 and the APL*PLUS/80 distribution workspace and file library disk from disk drive 1. Insert them in the disk envelopes, and turn off the power switch on your TRS-80.

APPENDIX C

SOFTWARE INSTALLATION INSTRUCTIONS -- LDOS

(For use with the LDOS operating system supplied by Logical Systems, Inc.)

In the front inside pocket of your APL*PLUS/80 binder is an APL*PLUS/80 "distribution" disk. The APL*PLUS/80 distribution disk cannot itself run the APL system. It contains only the APL*PLUS/80 system code. It does not contain LDOS, licensed to you by Logical Systems, Inc., which is needed to run the APL system. You must merge the APL*PLUS/80 distribution disk with an LDOS system disk, creating an APL*PLUS/80 "system" disk. You will also need to make a second disk for the APL*PLUS/80 workspace and file library. (Note that you will need four blank disks to perform the following steps.)

> CAUTION
>
> If you have never handled disks before, be sure to read about disks and disk drives in Chapter 1, "System Start-Up", before beginning these installation steps.

To install your APL*PLUS/80 system on a pair of working disks:

INSERT SYSTEM DISK

1. Remove the LDOS system disk supplied by Logical Systems Inc. from the disk envelope and insert the system disk into disk drive 0 (the bottom disk drive). (See Figure 1.4 which illustrates proper disk insertion.)

START UP LDOS

2. Turn on your TRS-80 Model III using the power switch which is located under the right side of the keyboard. Flip the power switch to turn on the computer; you'll hear a humming and buzzing sound. The sound is made by the disk drive motors starting. Wait until the disk drive motors stop and the drive select light goes off before proceeding to the next step; the computer is loading and starting the operating system software from the LDOS system disk in disk drive 0 and setting the system clock to midnight.

3. After you turn on your TRS-80 and the start-up program determines that everything is working properly, LDOS displays the LDOS logo and asks you to enter the date in the form MM/DD/YY; for example, 03/01/82 for March 1, 1982. If you make a mistake while typing, you can correct your error by pressing the backspace key (← on the key top) until the cursor erases the incorrect character, and then typing the correct information. When the date is correct, press the ENTER key. Note that LDOS will not allow you to enter an unrealistic date (for example, 13/42/82), and LDOS will not continue until you enter a date that's in the proper format (MM/DD/YY).

FORMAT A DISK

4. The instructions that follow assume that you are using LDOS Version 5.1.2, and the standard TRS-80 Model III disk drives as supplied by Radio Shack. Non-Radio Shack disk drives may call for different answers to some of the questions; consult the LDOS manual and your disk drive manuals for advice.

   Insert a new, blank disk in disk drive 1 (the top disk drive). Enter:

   FORMAT :1

   LDOS will now ask questions, to be answered as follows:

   DISKETTE NAME? *APLMASTR*
   MASTER PASSWORD? *PASSWORD*
   SINGLE OR DOUBLE DENSITY <S,D> ? *D*
   ENTER NUMBER OF SIDES <1,2> ? 1
   NUMBER OF CYLINDERS? 40
   BOOTSTRAP-STEPPING RATE <6, 12, 20, 30 MSECS> ? 0
   (Type 0 even though it is not a suggested choice.)

MAKE BACK-UP COPY OF LDOS SYSTEM DISK

5. When "LDOS Ready" appears, enter:

   BACKUP :0 :1

   The BACKUP program may display various alarming messages at this stage, such as "DIFFERENT PACK IDS! ABORT BACKUP?" (to which you should respond NO) or "CAN'T CLEAR MOD FLAGS". These are harmless and should be ignored.

6. Remove your original LDOS system disk from disk drive 0, insert it in the disk envelope, and store it in a safe place.

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7. Remove the disk from disk drive 1 and insert it in the disk envelope. Using a felt-tip pen to write gently on the disk label, identify this disk as your "master APL*PLUS/80 system disk". Insert your "master APL*PLUS/80 system disk" in disk drive 0.

DELETE UNNEEDED LDOS FILES

8. Next, create a "minimal" system to make room on your system disk for APL by deleting files from this disk which are not needed for APL use. Type:

   PURGE :0(*I*)

   The system displays the names of all files on the disk and asks if you want to delete (purge) each (Y=yes, delete it; *N*=no, leave it). All files should be deleted except RS232T/DVR, CONV/CMD, FORMAT/CMD, and BACKUP/CMD. (RS232T/DVR may be deleted if you do not intend to use the RS-232 facilities of APL.) If you later want to retrieve a program you've deleted in this step, you can make a copy of your original LDOS system disk and then repeat step 8 without deleting the program you want.

MAKE LDOS WORKSPACE TRANSFER DISK

9. Insert a new, blank disk in disk drive 1 (the top disk drive). Enter:

   FORMAT :1

   LDOS will now ask questions, to be answered as follows:

```
DISKETTE NAME ?  WS-XFER
MASTER PASSWORD ?  PASSWORD
SINGLE OR DOUBLE DENSITY <S,D> ?  D
ENTER NUMBER OF SIDES <1,2> ?  1
NUMBER OF CYLINDERS ?  40
BOOTSTRAP-STEPPING RATE <6, 12, 20, 30 MSECS> ?  0
(Type 0 even though it is not a suggested choice.)
```

   When "LDOS Ready" appears, enter:

   BACKUP :0 :1

   The BACKUP program may display various alarming messages at this stage, such as "DIFFERENT PACK IDS! ABORT BACKUP?" (to which you should respond NO) or "CAN'T CLEAR MOD FLAGS". These are harmless and should be ignored.

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10. When "LDOS Ready" appears, remove the disk from disk drive 1 and insert it in the disk envelope. Using a felt-tip pen to write gently on the disk label, identify this disk as your "LDOS workspace transfer disk", and set the disk aside.

11. Verify that the APL*PLUS/80 distribution disk supplied by STSC has write-protect tabs covering both write-protect notches. (If not, put write-protect tabs over the notches.)

COPY APL SYSTEM FILES FROM APL*PLUS/80 DISTRIBUTION DISK

12. Insert the APL*PLUS/80 distribution disk in disk drive 1 with the label side up. Enter:

    CONV /JCL:1 :0 (*Q=N*)

    When "LDOS Ready" appears, enter:

    DO = LDOSAPL

    The system will now convert the TRSDOS files on the APL*PLUS/80 distribution disk to LDOS files on the master APL*PLUS/80 system disk in disk drive 0 (this will take a few minutes). The master APL*PLUS/80 system disk now has the APL*PLUS/80 System on it.

13. When "LDOS Ready" appears, remove the APL*PLUS/80 distribution disk from disk drive 1, insert it in the disk envelope, and set it aside.

MAKE WORKING COPY OF MASTER APL*PLUS/80 SYSTEM DISK

14. Insert a new, blank disk in disk drive 1 (the top disk drive). Enter:

    FORMAT :1

    LDOS will now ask questions, to be answered as follows:

    DISKETTE NAME ? *APLWRKNG*
    MASTER PASSWORD ? *PASSWORD*
    SINGLE OR DOUBLE DENSITY <S,D> ? *D*
    ENTER NUMBER OF SIDES <1,2> ? 1
    NUMBER OF CYLINDERS ? 40
    BOOTSTRAP-STEPPING RATE <6, 12, 20, 30 MSECS> ? 0
    (Type 0 even though it is not a suggested choice.)

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When "LDOS Ready" appears, enter:

BACKUP :0 :1

This will copy the APL*PLUS/80 system with LDOS onto the disk in disk drive 1. The BACKUP program may display various alarming messages at this stage, such as "DIFFERENT PACK IDS! ABORT BACKUP?" (to which you should respond NO) or "CAN'T CLEAR MOD FLAGS". These are harmless and should be ignored. When "LDOS Ready" appears, disk drive 1 will contain a working copy of your APL*PLUS/80 system disk.

15. Remove the disk from disk drive 0, insert it in the disk envelope, and store it in a safe place.

16. Remove the disk from disk drive 1 and insert it in the disk envelope. Using a felt-tip pen to write gently on the disk label, identify this disk as your "working APL*PLUS/80 system disk" (which we will refer to as the APL*PLUS/80 system disk throughout this manual). Set the disk aside.

MAKE APL*PLUS/80 WORKSPACE AND FILE LIBRARY DISK

17. Insert the disk you created in step 9 (labeled "LDOS workspace transfer disk") in disk drive 0. Insert the APL*PLUS/80 distribution disk in disk drive 1 with the label side down. Enter:

CONV /AWS:1 :0 (*Q=N*)

When "LDOS Ready" appears, enter:

CONV /CMD:1 :0 (*Q=N*)

When "LDOS Ready" appears, enter:

LDOSINIT

18. When "LDOS Ready" appears, remove the disk from disk drive 1, insert it in the disk envelope, and set it aside.

19. Insert a new, blank disk in disk drive 1 (the top disk drive). Enter:

FORMAT :1

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LDOS will now ask questions, to be answered as follows:

```
DISKETTE NAME ?  APLWS+FL
MASTER PASSWORD ?  PASSWORD
SINGLE OR DOUBLE DENSITY <S,D> ?  D
ENTER NUMBER OF SIDES <1,2> ?  1
NUMBER OF CYLINDERS?  40
BOOTSTRAP-STEPPING RATE <6, 12, 20, 30 MSECS> ?  0
(Type 0 even though it is not a suggested choice.)
```

When "LDOS Ready" appears, enter:

BACKUP /AWS:0 :1

20. When "LDOS Ready" appears, remove the disk from disk drive 1 and insert it in the disk envelope. Using a felt-tip pen to write gently on the disk label, identify the disk as your "APL*PLUS/80 workspace and file library", and insert it in disk drive 1.

21. Remove the disk in disk drive 0 and set it aside; it will not be used again for the installation process, but you can use it as a blank disk in a later step.

22. Insert your APL*PLUS/80 system disk in disk drive 0. Enter:

START YOUR APL*PLUS/80 SYSTEM

APL

The APL system will load for about 10 seconds and display the APL*PLUS/80 logo. An initial workspace named INIO will be loaded automatically and will display a welcome message.

23. Execute a few APL statements and system commands to verify that your new APL*PLUS/80 system disk is working properly. For example:

TEST YOUR APL*PLUS/80 SYSTEM

- Type *)LOAD SYSTEST* and press the ENTER key. Your TRS-80 will display a message showing the date that the workspace was saved.
- Type *SYSTEST* and press the ENTER key. Your TRS-80 will display many lines of output; the last line displayed will be TEST FINISHED.
- When you have finished your test session, type *)OFF* and press the ENTER key.

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BACK-UP APL*PLUS WORKSPACE AND FILE LIBRARY DISK

24. Now is a good time to make a back-up copy of the APL*PLUS/80 workspace and file library disk in disk drive 1. (The instructions in step 14 can be used in the future when needed to make a copy of the APL*PLUS/80 system disk in disk drive 0.)

BACK-UP NON-SYSTEM DISKS

25. The instructions in this step can be used at any time to make a back-up copy of a working data disk (without LDOS). Insert your APL*PLUS/80 system disk in disk drive 0 and start up LDOS. When "LDOS Ready" appears, insert a blank disk (or a disk whose data can be discarded) in disk drive 1. Enter:

```
FORMAT :1
```

LDOS will now ask questions, to be answered as follows (where the xxxxxxxx is a name of your choice):

```
DISKETTE NAME ? xxxxxxxx
MASTER PASSWORD ?  PASSWORD
SINGLE OR DOUBLE DENSITY <S,D> ?  D
ENTER NUMBER OF SIDES <1,2> ?  1
NUMBER OF CYLINDERS ?  40
BOOTSTRAP-STEPPING RATE <6, 12, 20, 30 MSECS> ?  0
```

(Type 0 even though it is not a suggested choice.)

When "LDOS Ready" appears, enter:

```
BACKUP :0 :1 (X)
```

LDOS asks you to insert the source disk and press the ENTER key. Insert the working data disk in disk drive 0 and press the ENTER key. After processing the back-up, LDOS asks you to insert the system disk and press the ENTER key. Remove the working data disk from disk drive 0, insert it in the disk envelope, and set it aside. Insert the APL*PLUS/80 system disk in disk drive 0 and press the ENTER key. When "LDOS Ready" appears, remove the disk from disk drive 1 and insert it in the disk envelope. Using a felt-tip pen to write gently on the disk label, identify the disk as a copy of the working data disk.

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NOTE TO EXPERIENCED APL PROGRAMMERS

When using APL*PLUS/80 under LDOS, experienced APL programmers should note that:

- Since LDOS uses a separate RS-232T driver, if you plan to use the communications facility of APL, you will need to enter:

  *SET *CL RS232T*

  before starting the APL system. However, this command should not be used if you will not need the RS-232 facility in a particular APL session because it reduces workspace size by about 350 bytes.

- The baud rate for RS-232 communications must be set by parameters in the LDOS "set" command before starting APL. ⎕*POKE* ¯26627 is ignored when operating under LDOS. The default value is 300 baud.

- At present, the LDOS KI/DVR program is not supported when operating in APL.

- To allow overstrikes, line editing, and so on, APL*PLUS/80 uses its own video output routine and attempts to set, route, or link *DO will be ignored. However, turning on the parallel printer port (with CTRL 7 or 188 ⎕*POKE* 21062), is equivalent to the LDOS command LINK *DO *PR and further linkage may be carried out via the *PR DCB, using "phantom" control blocks if necessary.

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APPENDIX D

KEYBOARD AND DISPLAY CONTROL CODES

CTRL B (labeled ~~~N)	The status line is never displayed.
CTRL C (labeled ~~~A)	The status line is always displayed.
CTRL E (labeled EXP)	Shifts into or out of line expansion. In line expansion, material that you type is inserted at the cursor location, pushing anything at or to the right of the cursor further to the right to make room for the insertions.
CTRL I (labeled TAB)	Moves the cursor to the next tab position on the line. Tabs are set in every eighth position (1, 9, 17, 25, 33, 41, 49, 57). Maximum column width is 255 characters.
CTRL L (labeled LEFT)	Moves the cursor to the extreme left (the first column of the input being entered).
CTRL Q (labeled GO)	Resumes output that has been halted by a CTRL S.
CTRL R (labeled RIGHT)	Moves the cursor to the extreme right (just past the last character you typed on the current line, including any spaces that you typed there).
CTRL S (labeled STOP)	Causes output to pause. You can resume output with CTRL Q, or end output with the BREAK key.
CTRL V (labeled ~~~I)	The status line is displayed during input.
CTRL W (labeled WIPE)	Clears the unprotected portion of the screen and positions the cursor in the upper left corner. The input line is discarded.
CTRL Z (labeled EDIT)	Redisplays the last input line for editing and re-execution.
CTRL BACK (labeled CDEL)	Deletes the character above the cursor, and shifts to the left everything to the right of the cursor to fill the gap. If there is nothing above the cursor, the cursor moves one position to the left and erases the character in that position.

Displays a quote-quad (⍞).	CTRL . (labeled ⍞)
Produces a help message.	CTRL 0 (labeled HELP)
Holds the top 11 lines of the screen in a scroll-protected state. Pressing CTRL 1 again releases the scroll protection. (For more information on scroll protection, see the APL*PLUS/80 Programmer's Reference Manual.)	CTRL 1 (labeled HOLD)
Displays a right tack (⊣).	CTRL 2 (labeled /⊣)
Displays a left tack (⊢).	CTRL 3 (labeled ⊢)
Enters or leaves terminal mode (in which you can connect your TRS-80 to another computer), and sets or removes the TERMINAL note from the status line. (For more information on terminal mode, see the APL*PLUS/80 Programmer's Reference Manual.)	CTRL 4 (labeled TERM)
Displays a left brace ({).	CTRL 5 (labeled {)
Displays a right brace (}).	CTRL 6 (labeled })
Turns on or turns off access to a parallel printer. (WARNING: Do not press CTRL 7 unless a parallel printer is attached to your TRS-80 Model III and is ready to print. If a printer is not ready, the system will wait for it; to redisplay the cursor, press CTRL 7 again. For more information, see the APL*PLUS/80 Programmer's Reference Manual.)	CTRL 7 (labeled PRINT)
Displays a lamp symbol (⍀).	CTRL 8 (labeled ⍀)
Exits to immediate execution mode from another mode of operation. (For more information on immediate execution mode, see the APL*PLUS/80 Programmer's Reference Manual.)	CTRL 9 (labeled EXIT)

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GLOSSARY

An acronym for A Programming Language, an extremely concise, mathematically structured, computer language.	APL
A full-featured APL language processor for the Radio Shack TRS-80 Model III computer.	APL*PLUS/80
A program or group of programs designed to solve a specific problem. For example, a general ledger application.	application
A feature that allows you to hold down any key on the keyboard (except CTRL) for about 1/2 second to produce a sequence of that character.	automatic character repeat
On the TRS-80 Model III, a wheel located under the left side of the keyboard that is used to adjust the brightness of the screen display.	brightness control
A disk drive that is enclosed within the case of your TRS-80 Model III.	built-in disk drive
A synonym for "automatic character repeat."	character repeat
The numbers, letters, and symbols that are recognized by your computer.	character set
An abbreviation for "integrated circuit chip". A device that consists of ultraminiature transistors, diodes, and other components in one physical package forming the essential elements of a computer's electronic circuits.	chip
On the TRS-80 Model III, a wheel located under the left side of the keyboard that is used to adjust the contrast of the screen display.	contrast control
Special codes, created by holding the CTRL key while pressing a printing key, that either display an additional APL symbol or alter the environment.	control codes
A movable spot of light that appears on the video display screen during input and can be positioned horizontally by means of keyboard controls to tell the computer where the next character you type will appear, or where a correction, insertion, deletion, or other change is to be made.	cursor
A disk that is used to store APL data and/or APL programs. Compare "system disk".	data disk

disk	A low-cost storage device that consists of a flexible platter of magnetically coated mylar that is enclosed in a plastic jacket. The entire jacket is inserted in the disk drive.
diskette	A synonym for "disk".
disk drive	A device that electromagnetically reads information from, or writes information on, a disk.
disk jacket	The 5 1/4-inch square protective plastic cover enclosing a disk.
disk label	The adhesive label that is affixed to the disk jacket. The disk label is used for recording information about the disk.
disk envelope	The paper container used to store a disk when it is not in use.
display screen	A synonym for "video display screen."
drive	A synonym for "disk drive".
drive latch	The door that is used to control access of disks into and out of the disk drive.
drive select light	The red light on a disk drive that comes on when the computer is trying to use the disk drive.
entry editing diagnostic messages	Warning messages that appear on the status line indicating that the computer can't work with the information you've entered; for example, UNKNOWN OVERSTRIKE, OPEN QUOTE.
environment	The mode of operation of a computer.
external disk drive	A disk drive that is attached to, but separate from, your TRS-80 Model III.
file	A named collection of data stored on a disk in a prescribed sequence. The user can store information on, and retrieve information from, a file.
flexible disk	A synonym for "disk".
floppy disk	A synonym for "disk".
graphics characters	Characters composed of "white spots" in various combinations within a two-spot-wide by three-spot-high pattern.

Various methods that can be used to correct or change user entries before the ENTER key is pressed.	input editing commands
The portion of the TRS-80 Model III that contains the typewriter-like keys used for communicating with the computer.	keyboard
An alternate operating system for the TRS-80 Model III, licensed by Logical Systems, Inc.	LDOS
A twelve-key section to the right of the main TRS-80 Model III keyboard.	numeric pad
A data file that is activated for use in the current computer session.	open file
The large system program that supervises and controls the execution of other computer programs and provides various services (such as input and output) for other programs.	operating system
(To form) a character by using the backspace key to superimpose one character on top of another; for example, a SHIFT K ('), backspace, period (.) forms the overstrike character called shriek (!).	overstrike
A name that is used to extend the identification of a user or a workspace, thereby decreasing the possibility of unauthorized access.	password
A separate machine connected to your computer, such as an external disk drive, cassette tape unit, or printer.	peripheral device
On the TRS-80 Model III, a rocker switch located under the right side of the keyboard that is used to turn the power supply to the computer on and off.	power switch
On the TRS-80 keyboard, a key that causes a character to appear on the video display screen.	printing key
(To develop) a set of sequenced instructions that cause a computer to perform particular operations.	program
An acronym for Random-Access Memory; a type of computer memory that provides access to any location, allowing data to be written to or read from any location.	RAM
A small electromagnet used to read, write, or erase data on a magnetic storage device; for example, a disk or tape.	read/write head
An oval opening in a disk jacket that allows the read/write head of a disk drive to access the platter.	read/write window

remote computer	A computer that is distant from your TRS-80 Model III; that is, in another room, city, state, or country.
repeat	See "automatic character repeat".
ROM	An acronym for Read-Only Memory; a memory circuit used to provide a means of storing a fixed program in your TRS-80 Model III.
special character	A character that is neither a letter nor a number; for example, ! & /.
start-up program	A program in the operating system that tests the computer and asks you to enter the date whenever you turn on your computer or press the orange system reset button.
status line	A line at the bottom of the screen where notes are displayed to give you information about the system.
status line note	Information about the system that is displayed in the status line; for example, EXPAND, UNKNOWN OVERSTRIKE, OPEN QUOTE.
system clock	The time-of-day value that is continually updated by the operating system; you must give the computer a current time whenever you turn on your computer or press the orange reset button.
system code	The part of the APL*PLUS/80 system software that tells the computer what to do with APL commands.
system disk	A disk (used in disk drive 0 on your TRS-80 Model III) that contains a copy of the system programs (operating system and APL language processor).
system reset button	The recessed orange button at the right edge of the TRS-80 Model III keyboard which discards everything in your computer's memory (except the date) and reloads TRSDOS from the system disk in disk drive 0.
text characters	Printing characters in the APL*PLUS/80 character set other than graphics characters or special characters.
TRSDOS	The operating system for the TRS-80 Model III, supplied to you by Radio Shack and licensed to you for use on your computer.
underbar	In APL, the symbol _ (SHIFT F). Also called underscore.

The area of your TRS-80 Model III that resembles a television screen.	video display screen
An area on a disk that is used to tell a disk drive whether the computer is allowed to write (store programs and data files) on the disk.	write-protect notch

REFERENCES

The publications listed below will provide you with additional information about the APL language, APL*PLUS/80 System features, and your TRS-80 Model III.

1. APL: An Interactive Approach, L. Gilman and A. J. Rose, John Wiley & Sons, Inc., 1976. Provides a detailed introduction to APL on a broad selection of topics.

2. APL Is Easy, STSC, 1982. Provides an introduction to APL that has been developed specifically for people beginning to use APL.

3. APL*PLUS/80 Formatting User's Guide, STSC, 1982. Describes the features available in your system for creating formatted reports.

4. APL*PLUS/80 Programmer's Reference Manual, STSC, 1982. Provides both general information and specific reference material for the features in your system, and includes many helpful hints on efficient programming.

5. APL*PLUS/80 Shared File System User's Guide, STSC, 1982. Describes the operation of files in your system.

6. TRS-80 Model III Disk System Owner's Manual, Tandy Corporation, 1980. Describes the operation of your TRS-80, and the TRSDOS command language.

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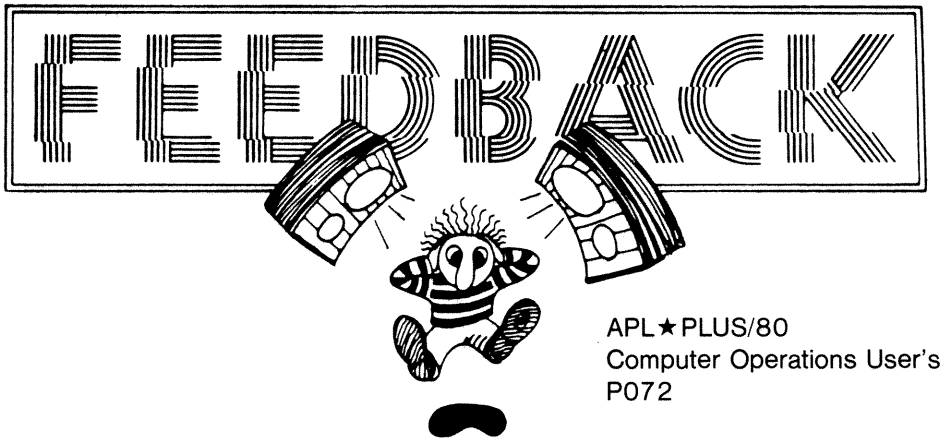

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